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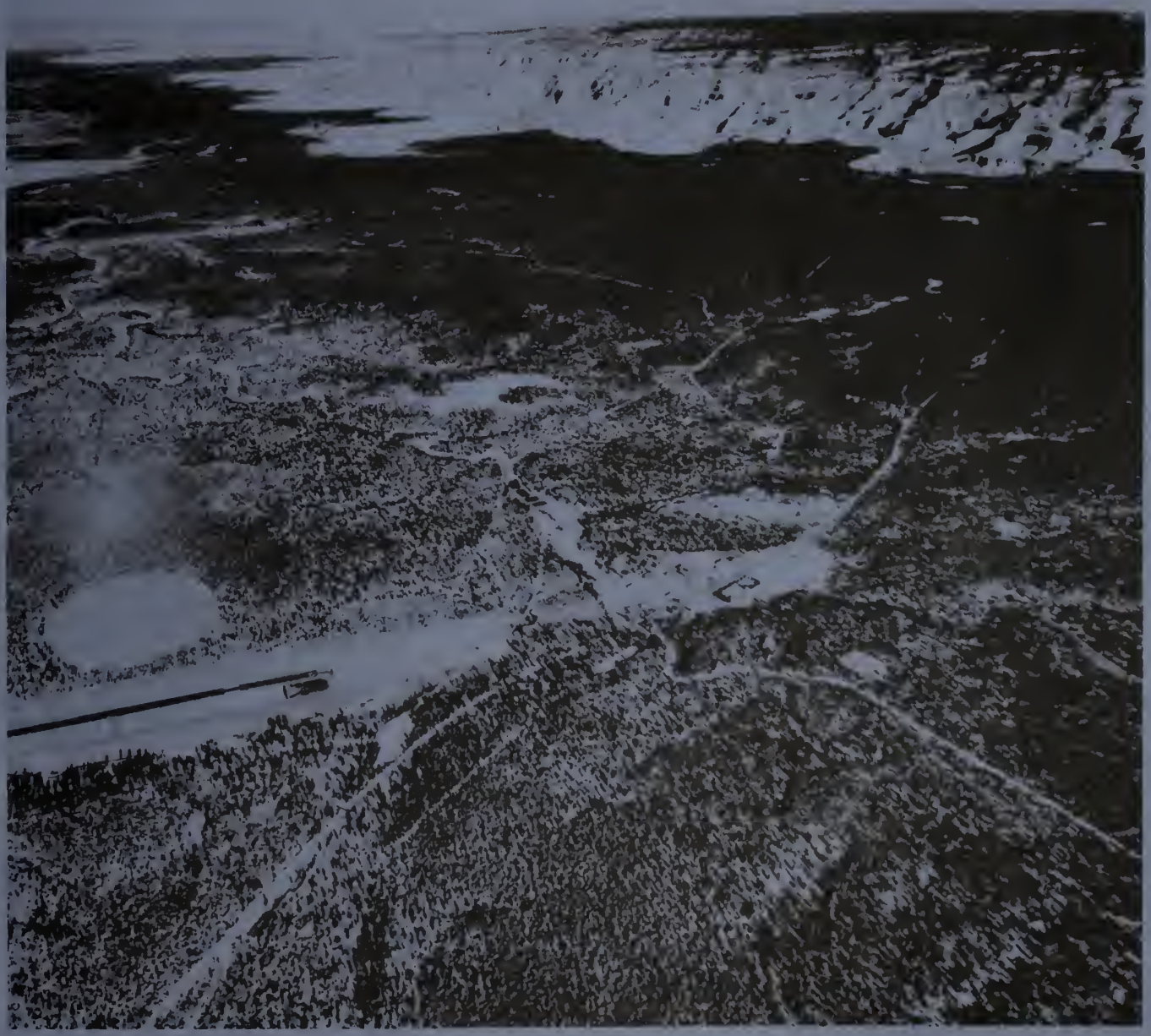
Forest Service

Southwestern Region

# Supplement to the Draft Environmental Impact Statement for Tusayan Growth

## Kaibab National Forest



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# Supplement to the Draft Environmental Impact Statement

## for
## Tusayan Growth
## Coconino County, Arizona

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|---|---|
| **Lead Agency:** | USDA Forest Service<br>Kaibab National Forest |
| **Cooperating Agencies:** | USDI, Grand Canyon National Park<br>Coconino County<br>Northern Arizona Council of Governments |
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**Abstract**

The Supplement to the Draft Environmental Impact Statement describes three new alternatives for providing improvements to transportation, housing, community facilities, and visitor services outside of Grand Canyon National Park boundaries on private or National Forest land in the Grand Canyon/Tusayan area. Alternatives considered are Alternative F: Townsite Act Option 2/Special Use Permit, Alternative G: Land Exchange Option 3/Special Use Permit, and Alternative H: Land Exchange Option 4/Special Use Permit. Alternative G is the Preferred Alternative.


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# Acronyms and Abbreviations

| | |
|---|---|
| **AC** | Acre |
| **ACOE** | Army Corps of Engineers |
| **ADEQ** | Arizona Department of Environmental Quality |
| **ADOT** | Arizona Department of Transportation |
| **ADWR** | Arizona Department of Water Resources |
| **AGFD** | Arizona Game and Fish Department |
| **APS** | Arizona Public Service |
| **ASHRAE** | American Society of Heating, Refrigeration, and Air-conditioning Engineers |
| **BDMP** | Best Design and Management Practices |
| **BNSF** | Burlington Northern/Santa Fe Railroad |
| ca | Circa |
| **CAP** | Central Arizona Project |
| **CAWCD** | Central Arizona Water Conservation District |
| **CC&R** | Covenants, Conditions, and Restrictions |
| **CEQ** | Council on Environmental Quality |
| **CFC** | Chloroflurocarbons |
| **CFV** | Canyon Forest Village |
| **CFVC** | Canyon Forest Village Council |
| **DPS** | Department of Public Safety |
| **DUI** | Driving Under the Influence |
| **EA** | Environmental Assessment |
| **EIS** | Environmental Impact Statement |
| **EPA** | Environmental Protection Agency |
| **EPTE** | Environmental Preservation Trust Entity |
| **FAA** | Federal Aviation Administration |
| **FAR** | Federal Aviation Regulation |
| **FLEFA** | Federal Land Exchange Facilitation Act |
| **FLPMA** | Federal Land Policy and Management Act |
| **FMC** | Flagstaff Medical Center |
| **FR** | Forest Road |
| **GCIA** | Grand Canyon Improvement Association |
| **GCNP** | Grand Canyon National Park |
| **GMP** | General Management Plan |
| **GPD** | Gallons per Day |
| **GPM** | Gallons per Minute |
| **HAZMAT** | Hazardous Materials |
| **HCFC** | Hydrochloroflurocarbons |
| **HUD** | U.S. Department of Housing and Urban Development |
| **HWY** | Highway |
| **IGA** | Intergovernmental Agreement |
| **IO** | Isolated Occurrence |
| **INM** | Integrated Noise Model |
| **KNF** | Kaibab National Forest |
| **Ldn** | Day-Night Average Sound Level |
| **LEED™** | Leadership in Energy and Environmental Design |
| **LNG** | Liquified Natural Gas |
| **M** | Millions |
| **MGY** | Millions of Gallons per Year |
| **MNA** | Museum of Northern Arizona |
| **MOA** | Memorandum of Agreement |
| **MSL** | Mean Sea Level |
| **NACA** | Native Americans for Community Action |
| **NACOG** | Northern Arizona Council of Governments |
| **NEPA** | National Environmental Policy Act |
| **NF** | National Forest |
| **NFS** | National Forest System |
| **NPDES** | National Pollution Discharge Elimination System |
| **NPS** | National Park Service |
| **PHA** | Public Housing Authority |
| **PILT** | Payment in Lieu of Taxes |
| **RD** | Ranger District |
| **RNA** | Roaded-Natural Area |
| **ROD** | Record of Decision |
| **ROS** | Recreation Opportunity Spectrum |
| **ROW** | Right-of-Way |
| **SAS** | Solar Aquatics System |
| **SHPO** | State Historic Preservation Office |
| **SPM** | Semi-Primitive Motorized |
| **SQ.FT.** | Square Feet |
| **TCP** | Traditional Cultural Property |
| **TES** | Threatened, Endangered, and Sensitive Species |
| **USDA** | U.S. Department of Agriculture |
| **USDI** | U. S. Department of Interior |
| **USFS** | U.S. Forest Service |
| **USGBC** | U.S. Green Building Council |
| **VOC** | Volatile Organic Compounds |
| **USGS** | U. S. Geological Survey |
| **VQO** | Visual Quality Objective |
| **WQARF** | Water Quality Assurance Revolving Fund |

# Chapter 1 Purpose and Need for Action



## Introduction

In June 1997, the draft Environmental Impact Statement for Tusayan Growth (draft EIS) was released for public comment. The goal of the draft EIS was to present and evaluate alternatives for growth in the Tusayan area that would protect the natural and cultural resources in the Grand Canyon/Tusayan area and address needs for transportation improvements, housing, community facilities, and visitor services outside of Grand Canyon National Park (GCNP) boundaries through the use or acquisition of National Forest System (NFS) land in Kaibab National Forest (KNF). Guidelines for many of the improvements contained in the five alternatives considered in the draft EIS came from the General Management Plan (GMP) adopted by the National Park Service (NPS) in 1995 for GCNP.

The National Environmental Policy Act (NEPA) requires preparation of a supplement when new information relevant to environmental concern arises. Further analysis of impacts to water resources and socioeconomic impacts prompted by public comment yielded new information on these issues. Three new alternatives have also been developed based on comments received that also require public comment. Finally, the supplement will identify the preferred alternative.

Over 900 comment letters were received on the draft EIS, many of which questioned the hydrologic and socioeconomic analyses. The supplement incorporates information from the draft EIS and appended materials. Information included in the draft EIS will not be repeated in this supplement unless necessary to the understanding of discussion or display of analysis results. Where there are changes in information, the supplement and associated technical materials present the best available information and supersede previous information presented in the draft EIS.

The remainder of Chapter one presents the project objectives, and the existing and desired conditions. New material added to this section includes an existing and desired condition for natural resources and for cultural resources. Chapter two of this document contains a description of the three new alternatives, new mitigation and monitoring requirements for the alternatives, and a comparison and summary of all the alternatives. Chapter three gives new information on the private inholdings, the results of further analyses of groundwater and socioeconomics, and new analysis of Grand Canyon seeps and springs. Chapter four presents the environmental consequences for all resources for the three new alternatives and a discussion of impacts of the alternatives described in the draft EIS for which new information is available.

## Project Objectives

Based on the desired future condition statements discussed below, the Interdisciplinary (ID) Team has developed three project objectives:

1) Land ownership pattern in the Grand Canyon/ Tusayan area facilitates efficient and effective management of public and private land;

2) Provide land to facilitate coordinated development of community (e.g., housing, school, houses of worship, day care, community center, etc.) and visitor (e.g., guest lodging, retail, food and beverage) services and facilities in the Grand Canyon/Tusayan area; and,

3) Provide land near Tusayan for a parking and mass transit system for GCNP.

## Existing Situations and Desired Conditions

The objective of the Tusayan Growth EIS is determining 1) how best to provide for improvements to land management, transportation, housing, community facilities, visitor services outside of park boundaries, while protecting natural and cultural resources of the area, and 2) whether NFS land should be used for these purposes. The five original alternatives and three new alternatives under consideration provide for these needs in different ways and to varying extents. To evaluate the alternatives, the ID Team identified the desired future conditions for the primary components of the environment under analysis in this EIS.

The desired conditions for the Grand Canyon/Tusayan area are those conditions necessary for the efficient management of NFS land by the KNF as well as those that provide solutions to many of the changes called for in the GCNP GMP.

The GMP proposes changes to four important areas that affect land use in the Grand Canyon/Tusayan area. First, the plan calls for expansion of the mass transit system in the park and addition of a parking lot and transportation staging area outside park boundaries. Second, the GMP caps residential growth in the park near current levels and proposes that additional housing needs be met outside the park. Third, the plan proposes that expansion of community facilities also be accomplished outside rather than inside the park. Finally, the plan allows for little increase in visitor services and facilities in the park. This means that the increased demand for lodging, retail, and food and beverage services created by increased visitation would have to be met outside GCNP or on other federal, tribal, state, or private lands.

The existing situation and the desired conditions for the seven primary components of the environment under analysis in the Grand Canyon/Tusayan area are as follows:

## Land Ownership Management

### Existing Situation

- Numerous undeveloped private inholdings currently exist within the Tusayan Ranger District. Some of these inholdings have natural and cultural resource values that could be important additions to the National Forest. Several private inholdings are located in close proximity to GCNP or to road access and are believed to have future development potential. The development of these inholdings could impact the management of adjacent NFS and NPS lands and create additional stress on county-provided services.

### Desired Condition

- The land ownership pattern facilitates efficient and effective management of public and private lands. Undeveloped private inholdings with important natural and cultural resource values have been acquired by the Forest Service. Development of private land is consistent with the management objectives of the KNF, GCNP, and Coconino County.

## Transportation System

### Existing Situation

- High visitation rates and inadequate parking in and around Grand Canyon Village are the primary factors contributing to traffic congestion during the summer season. Insufficient space designated for parking results in unauthorized roadside parking, increasing traffic congestion by reducing driving space and increasing the number of pedestrians on the roads (GCNP 1995:162).

- The majority of visitors (78%) access the park in private vehicles (GCNP 1995:161), leading to traffic congestion and difficulty in finding parking. Other transportation modes are not well developed or easy to use.

- Roads in and near Grand Canyon Village generally operate near capacity. By 2010, use of most of these road segments are expected to exceed capacity, and traffic congestion is expected to worsen with increasing traffic volumes (GCNP 1995:166).

### Desired Condition

- GCNP works with area partners to develop a transportation staging area and transit center outside of GCNP. The transit center provides regional trip-planning information, restrooms, telephones, information kiosks, day parking, and access to transit service to GCNP. The transportation staging area will be the primary site where visitors will leave their vehicles and access a transit service to the park.

- Transit service, hiking, and biking are the primary year-round modes of travel for visitors to the South Rim. Most vehicles are excluded from Grand Canyon Village.

- Roads in the park operate at a level that is comfortable and convenient for visitors and residents.

## Housing Needs

### Existing Situation

- GCNP has identified a need for up to 500 housing units (100 units for NPS employees and up to 400 units for park concessionaire employees) outside of park boundaries (GCNP 1995:171).

- The population of Grand Canyon/Tusayan is estimated at about 2,300 permanent residents and grows to about 3,200 during the summer. Few housing options are available in the area for park and Tusayan business employees. Existing housing is often of poor quality and overcrowded. Many who work in the Grand Canyon area commute from Valle or from further away because housing that fits their needs is unavailable in the Grand Canyon/Tusayan area.

- The housing problem affects all employers and most employees in the area; many think that it is the most persistent problem faced by local residents. While residentially zoned land exists in Tusayan, there is little "open market" housing because of high land and development costs and low employee income. Since housing in Tusayan is generally provided by employers, employees risk losing their housing accommodations when jobs end.

### Desired Condition

- Up to 500 housing units are provided near the park to house NPS and park concessionaire employees who cannot be accommodated inside park boundaries. These units are adjacent to Tusayan and include different types of units (e.g., single-family, apartments, and dormitories).

- Residential housing is located in a single area, with community facilities and services in close proximity. Additional housing is provided for new employees who may come to the area in the future.

## Planning for Community Needs

### Existing Situation

- Development in Tusayan to date has followed market forces. The Tusayan Area Plan adopted by the Coconino County Board of Supervisors in 1995 provides some goals and policies for future development. Outside of this EIS process, there is no ongoing, comprehensive land-use planning effort or financing plan for Tusayan that provides for community facilities.

- Agency officials desire to cooperate with each other and with private entities to influence future development in the Tusayan area. Planning for growth in Tusayan has implications for GCNP and KNF management and the visitor experience at GCNP, KNF, northern Arizona, and outlying communities. Currently, almost all community facilities serving the Grand Canyon/Tusayan population are located inside GCNP, including a school, a day-care facility, a library, a shared place of worship, a medical clinic, recreational facilities (indoor and outdoor), and most emergency services. As Tusayan grows, the need to expand existing facilities or provide new facilities for schools, police and fire protection, medical services, and other community services will increase.

### Desired Condition

- Community facilities and services are developed in Tusayan in a coordinated, planned fashion. Such facilities and services include additional schools; houses of worship; a day-care center; police, fire and emergency services; medical facilities; community parks; recreation centers; playgrounds; coin-operated laundries; banks; and grocery/supply stores.

- Grand Canyon Village continues to provide services for the in-park community. Expansion of these facilities occurs outside the park, as does development of any new community facilities that are needed to serve an increased resident population.

## Planning for Visitor Needs

### Existing Situation

- Average daily visitation to the South Rim is 17,600 people during the summer months. Within the park, day-use visitors stay an average of 4 hours; overnight visitors stay an average of 1.2 days.

- The GCNP GMP identifies a lack of information and orientation materials and services available to visitors entering the park, as well as inadequate and overcrowded orientation/interpretive facilities within the park. Information that is available is too general and outdated. Visitors who stop at regional information centers find it difficult to obtain up-to-date information on park accommodations.

- The demand for in-park lodging and camping facilities exceeds current supply. There are 1,033 lodging units and 433 campground sites at the South Rim of GCNP. Visitors who do not obtain reservations in the park attempt to find accommodations in Tusayan, Flagstaff, Williams, or other outlying communities, or camp in the adjacent Forest or illegally in the park.

- Grand Canyon Village offers limited food and beverage services for visitors. Visitors experience delays or have limited options, especially during peak visitor periods.

- Since 1992, 485 hotel rooms have been constructed in Tusayan, bringing Tusayan's total lodging units to 931. Another 160 units have been approved for construction by the Coconino County Board of Supervisors. Construction of 120 of these rooms is expected to finish in 1998.

### Desired Condition

- Circulation patterns in Grand Canyon Village are organized so that visitors have convenient access to the rim, can learn about park themes, can safely experience the entire area, and can obtain a diversity of visitor services without delays.

- Visitors have access to conveniently located, up-to-date, informative interpretive facilities and programs.

- Overnight accommodations are in locations that meet the expectations, needs, and preferences of visitors.

- Additional food and beverage facilities both inside and outside the park can accommodate peak visitor demand.

- Available retail options are consistent with the park setting and meet the needs of visitors.

## Natural Resource Management

### Existing Situation

- Biotic communities adjacent to and within GCNP and KNF are vulnerable to impacts from well development tapping the regional groundwater aquifer and from human disturbance of undeveloped private land in the area.

### Desired Condition

- Important biotic communities in the Grand Canyon/Tusayan area, including wildlife movement in and out of GCNP, are not significantly disrupted by development or by the increased presence of visitors and residents. The amount and location of groundwater withdrawals do not significantly impact sensitive seeps and springs in Grand Canyon.

## Cultural Resource Management

### Existing Situation

- Cultural resources in the Grand Canyon/Tusayan area are not well understood or interpreted, and are vulnerable to impacts from land development and associated human disturbance.

### Desired Condition

- Cultural resources in the Grand Canyon/Tusayan area are well understood. Important cultural properties are identified and interpreted for the public. Cultural resources in the Grand Canyon/ Tusayan area are protected from development and human disturbance.

# Chapter 2 Description of Alternatives



## Introduction

This chapter presents three new alternatives, two of which were created by the ID Team (Alternatives F and G) after considering public comments on the draft EIS, and one (Alternative H) that was developed by the proponent, Canyon Forest Village (CFV). Alternative F incorporates aspects of Alternatives D and E, while Alternatives G and H incorporate aspects of Alternatives B, C, D and E. Also discussed in this chapter are alternatives eliminated from further consideration following release of the draft EIS last summer, sustainable design elements for all the alternatives, mitigation and monitoring, and matrices comparing and summarizing all eight alternatives.

## Formulation of New Alternatives

The new alternatives considered in detail include: Alternative F: Townsite Act Option 2/Special Use Permit, Alternative G: Land Exchange Option 3/ Special Use Permit, and Alternative H: Land Exchange Option 4/Special Use Permit. While CFV is the proponent of Alternative H, they would implement either Alternative G or H.

## Alternatives Eliminated From Further Consideration

Since the development of the original five alternatives in the draft EIS, the Grand Canyon Improvement Association (GCIA) proposed a land exchange alternative that would meet their needs for redevelopment of Tusayan. This alternative and the reason for it's elimination from further consideration is discussed below.

### GCIA Land Exchange

GCIA's alternative described in the draft EIS does not allow GCIA to reserve housing for a certain business (or employee segment) because of requirements under the Townsite Act and forming a County Improvement District (see pages 185-186, 222 draft EIS). To rectify this problem, GCIA proposed a combination Townsite Act/Land Exchange to achieve employee-specific housing. The GCIA was unable to provide evidence of land ownership or rights to the private land offered in the land exchange as required by the Forest Service. The Forest Service, therefore, eliminated this alternative from further consideration.

## New Alternatives Considered in Detail

### Alternative F

#### Introduction

This alternative, created in response to public comment on the draft EIS, represents components of both Alternatives D and E. The purpose is to provide 40 acres of federal land for purchase at market value under the Townsite Act to accommodate community facility needs while allowing for transportation improvements under a Special Use Permit, independent of the Townsite Act land acquisition. Housing for nonfederal employees is not part of this alternative as many of those who commented on the draft EIS objected to the use of federal land for employee housing for private businesses. A limited amount of housing, 100 units, would be provided on 10 acres of NFS land for federal employees under a Memorandum of Agreement (MOA) between the U.S. Departments of Interior and Agriculture. Components of this alternative would meet standards established in the Tusayan Area Plan. Figure 2.1 depicts the NFS land that would be allocated for community facilities, federal housing, and transit center. The concept plan illustrating the location and spatial relationship of the transportation staging area and orientation center (hereafter called the Grand Canyon Transit Center), the community services, and the NPS housing are shown in Figure 2.2. The amount of acres allocated for each use are listed in Table 2.1.

#### Visitor Segment

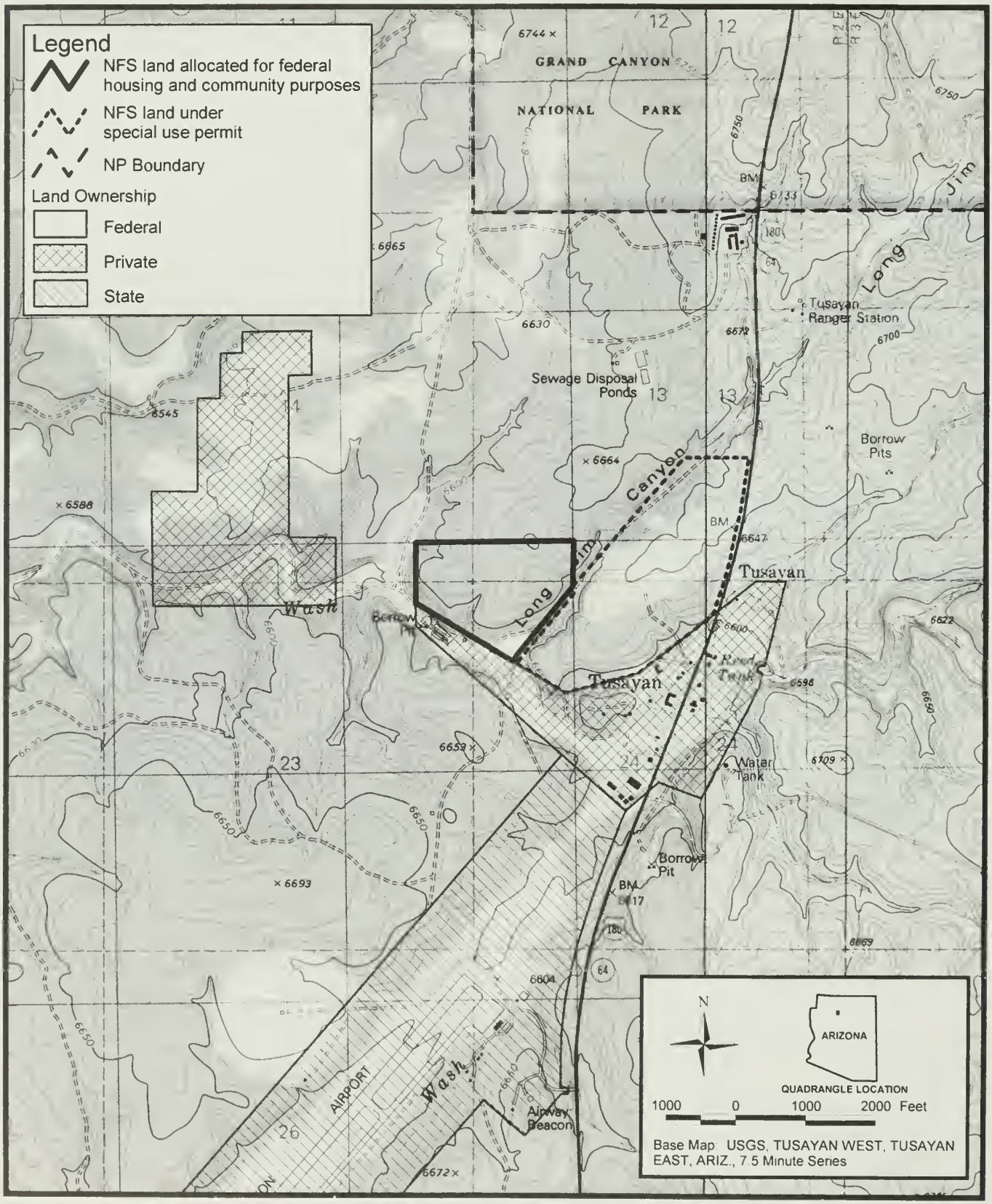
##### Lodging and Recreational Facilities

No lodging, camping or RV facilities are proposed.

##### Visitor Retail

Up to 2,000 square feet of the transit center would be used for limited visitor services such as purchasing pre-prepared food items, bottled water, and film. No commercial development would occur on federal land beyond that associated with the transit center.

Figure 2.1 Footprint of NFS land involved in Alternative F



### Orientation/Interpretation

Orientation information would be provided by booths and exhibits at the transit center. The booths would provide assistance to visitors using the transportation system to and from GCNP and provide general information about services in the Grand Canyon/ Tusayan area, including local businesses, attractions, and events. Other elements would include exhibits established in the lobby of the transit center; information panels, exhibits and monitors in the passenger loading area; and information panels inside the transit vehicles.

## Community Segment

### Residential

Under this alternative, housing would be limited to NPS or other federal employees. An MOA between the U.S. Departments of Interior and Agriculture would set aside 10 acres of NFS land for 100 apartment and dormitory units. If the project were federally funded, rents would be determined using an established government formula, as is currently used at GCNP. If the transit provider builds the housing, rents would be established based on current market rates. Housing would be adjacent to Tusayan, west of Long Jim Canyon as shown in Figure 2.2.

### Community Segment

Alternative F would make 40 acres of NFS land available for purchase at market rate based on highest and best use by individual governmental entities to build community facilities. Up to 27 acres of the 40 acres of unimproved land (no access or infrastructure) would be available for a school site. The remaining area would be available for a library, fire/police station, community center, and other community facilities as individual entities acquire land from the Forest Service. Individual entities would be required to finance and construct their own infrastructure and facilities to serve the designated land. Land proposed for purchase under the Townsite Act is shown in Figure 2.1.

## Transportation Segment

### Transportation Staging Area

A Special Use Permit for approximately 60 acres of NFS land, north of the IMAX theater between Long Jim Canyon and State Highway 64, would be available for competitive bid by a private concessionaire to construct the Grand Canyon Transit Center and to provide public transportation to and from GCNP (Figure 2.2). The Grand Canyon Transit Center would consist of parking areas, a transit center, and a rail system from the transit center, crossing over Long Jim Canyon and traversing NFS land into GCNP. A sixty foot-wide corridor in Long Jim Canyon from the transit center to the private property boundary of Tusayan would be reserved for a potential future rail connection to Grand Canyon Airport.

The transit center would provide parking for approximately 3,500 vehicles on federal land, constructed and managed by the transit provider. The number of parking spaces would be determined by the NPS. The transit center would serve as the transfer point from private vehicles to the mass transit system into GCNP. The transit provider would operate a shuttle services to transport people from the parking area to the transit center. Additional federal land would be available west of Long Jim Canyon for future expansion of parking, if needed. Additional environmental analysis and documentation under NEPA would be required for any expansion proposals.

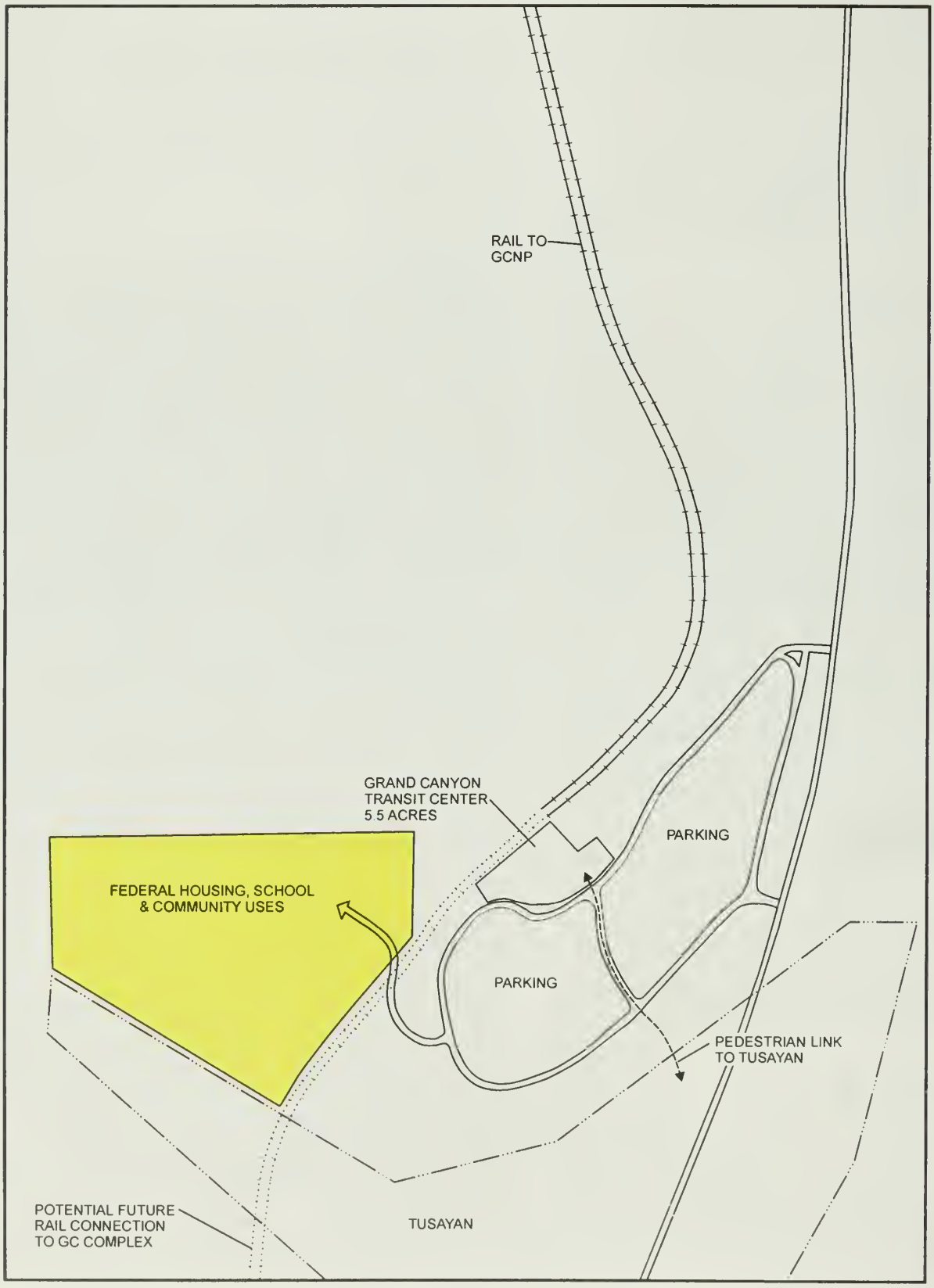
### Trails and Foot Paths

The transit provider would build a pedestrian sidewalk on NFS land from the transit center to the IMAX theater adjacent to the Grand Canyon Transit Center parking lot. The transit provider would not be required to construct or provide pedestrian access to GCNP. However, this alternative does not preclude the NPS, KNF, or community groups from constructing a pedestrian/equestrian path from Tusayan to GCNP or other recreational areas in KNF.

### Roadway Improvements

The transit provider would be responsible for constructing necessary improvements to State Highway 64 for access to the Grand Canyon Transit Center. Individual governmental entities would be responsible for construction and maintenance of all roads within Townsite Act acquired land, including a road link to Tusayan. The NPS would be responsible for construction and maintenance of roads within the residential section designated for NPS and other federal employees.

Figure 2.2 Concept Plan for Development in Alternative F



## Architecture Design, Site Planning, Sustainable Elements, and Resource Conservation

Architecture design features define the character, aesthetics, structure, and function of the development. Site planning includes a description of how existing topography, vegetation, soil removal, and drainage would be incorporated into the design, as well as explaining the amount of open space and type of night-lighting proposed. Sustainable elements include components with the ability to sustain diversity, productivity, resilience to stress, health, renewability, and/or yields of desired values, resource uses, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time. Resource conservation includes a discussion of the types of measures proposed to conserve resources (e.g., energy). All of these features (design, planning, conservation, and sustainable elements) are interrelated. Community facilities constructed on acquired federal land under the Townsite Act would conform to guidelines in the Coconino County Comprehensive Plan and Tusayan Area Plan.

### Architecture Design

Architectural design of the transit center would follow the GCNP Architectural Character Guidelines. Colors for buildings and facilities would be compatible with the existing natural surroundings.

### Site Planning

The community facilities are located adjacent to the existing residential area of Tusayan and proximate to the transit center to facilitate integration of new development with the existing community.

Designated open space would be limited under this alternative. Open areas or natural buffer zones would be maintained around the transit center. By limiting the size of the development, natural or undeveloped NFS land would remain to the north, east, and west of the development to serve as open space. Natural areas of ponderosa pine and other native vegetation would be retained within the visitor parking area and adjacent to the transit center to maintain a natural setting. Night lighting would be accomplished by using conventional lights and would conform to the provisions of the Coconino County Lighting Ordinance for Zone III, as specified in the Coconino County Comprehensive Plan and the Tusayan Area Plan.

### Sustainable Elements

Building materials, waste management, landscaping and exterior design, resource conservation, and specialized open spaces adopt standard materials, practices, and components. Sustainable elements, incorporated in the design of the transit center and federal housing, would be used when the benefits outweigh the costs.

### Resource Conservation

The Tusayan Area Plan and Coconino County Comprehensive Plan would guide resource conservation and waste minimization efforts. A basic recycling program, like that proposed for Tusayan, would be implemented by the community users, federal housing residents, and the transit provider. Water conservation would be achieved through the use of low-flow fixtures for flush toilets, urinals, and lavatories in the employee housing units and in the transit center. Low-flow showerheads and faucets would also be installed in federal employee housing units. Reclaimed water (nonpotable) could be purchased from the South Grand Canyon Sanitary District (SGCSD), provided by an on-site wastewater treatment facility if agreement with the SGCSD cannot be reached, and from water harvested off the transit center parking lot for use in flushing toilets and irrigation.

Energy conservation would include building placement and design to take advantage of opportunities for passive solar heating and use of building materials to reduce energy consumption.

## Infrastructure

### Water

Potable water for the proposed development (excluding the community uses) of an estimated 7 million gallons per year (mgy) would be drawn from the GCNP's water supply that originates within Grand Canyon at Roaring Springs. Water would be transport by an underground pipeline from the South Rim to a storage tank installed adjacent to the proposed transit center. The residential and community segments would tie into the storage tank via underground pipelines for their water needs. If

GCNP water is not available for community facilities, each facility would have to purchase water from off-site sources, which could include groundwater obtained from wells or water purchased and hauled from outlying areas. Nonpotable water would be obtained from the SGCSD for toilet flushing and irrigation. The transit provider would harvest approximately 5 mgy of nonpotable water from the parking lot for use at the transit center.

### Energy

Electricity would be the primary energy source for development, drawn from an APS transmission line that crosses the site. All utilities would be buried, unless otherwise approved by the Coconino County Board of Supervisors or other approving agencies. Passive solar elements would be incorporated into the architectural design where benefits exceed cost.

### Solid Waste Management

Solid waste would be hauled to a Coconino County operated transfer station southeast of Tusayan. From there, the county hauls the waste to the city landfill northeast of Flagstaff. Solid waste would be reduced by implementing a basic recycling program at the transit center and federal housing complex.

### Wastewater Management

The transit center, federal housing, and community facilities would tie into the SGCSD via 6-inch to 10-inch diameter pipes. It is estimated that between 0.5 and 1 mile of pipeline would have to be installed to tie into the Tusayan system. This plant has a capacity of 750,000 gallons per day (gpd) and, at this time, can accommodate additional wastewater generated by the uses proposed in this alternative. Multi-family units would be dual-plumbed to use of reclaimed wastewater for landscaping and toilet flushing. The transit provider and individual governmental entities would be responsible for connection to the existing system. If agreement to tie into the SGCSD facility cannot be made, a new wastewater treatment facility would be built on NFS land.

## Project Implementation

### Governance

Governance for the transit center would be achieved through the administration of the terms and conditions of the special use permit. Governance for the federal housing would be administered under the terms and conditions of the MOA or other instruments executed between the U.S. Departments of Interior and Agriculture. The community services would be governed through the county zoning process.

## Project Cost

The transit center would cost an estimated $17 million and the federal housing would cost $10.4 million. Construction and operation costs of the transit center would be the responsibility of the transit provider. The federal housing could be financed by appropriated funds, increased monthly rent charged to federal employees for housing, or reallocation of GCNP entrance fees. Some financing options for the federal housing would require congressional approval. Cost estimates for the community facilities have not been developed, but all costs associated with the community facilities would be the responsibility of the sponsoring governmental entity. These costs would include purchase of federal land at market value based on highest and best use, development of infrastructure, and building and operation costs.

Private investment in the transit center would be recouped through GCNP visitor entrance fees. Additional revenue would be obtained from the 2,000 square feet of visitor-oriented convenience retail in the transit center. The special use permit would be managed by the NPS and Forest Service with a portion of the collected fees being disbursed to both agencies.

## Implementation Schedule

The transit center, federal housing, and community facilities would be implemented independent of one another. The transit center would begin construction after completing the final EIS/ROD, acquiring necessary permits and licenses, and selecting a transit provider. Federal housing could be implemented as needed, after completing the final EIS/ROD. The community facilities could be constructed on an individual basis as qualifying entities acquire land from the Forest Service under the Townsite Act, again following the final EIS/ROD.

## Alternative G (Preferred Alternative)

### Introduction

In response to public comment on the draft EIS, a scaled-down land exchange alternative was created by the ID Team. Alternative G, the preferred alternative, allows for acquisition of the private inholdings, reduces the amount of commercial development as proposed in the previous land exchange alternatives, provides an improved land base or building space for community facilities for residents of the Grand Canyon/Tusayan area, and allows for a transit center to be built independently of other aspects of the alternative (as described in Alternative F). Although not a primary factor, this alternative incorporates sustainable design elements where economically feasible, and meets or exceeds standards established in the Tusayan Area Plan.

CFV would implement this alternative if selected. Through the land exchange, CFV would acquire 270 acres of NFS land, north of Tusayan and west of State Highway 64 (Figure 2.3). This land would be used to construct a gateway community to GCNP. The function of this community would be to provide visitor services and facilities outside GCNP, alleviating pressures on the park caused by increased visitor demand; provide housing for area employees, alleviating pressures to build more employee housing in the park; provide an improved land base for community facilities, providing an opportunity for the development of community facilities to serve residents of Tusayan, GCNP, and CFV; and develop INSIGHT, an experiential, educational and interpretive center, expanding the educational and interpretive experience of GCNP visitors.

The Forest Service would acquire private inholdings in the Tusayan Ranger District that are equal to the value of the NFS land traded to CFV (Figure 2.4). Private inholdings would be acquired in order of highest developmental potential and resource values (rationale for private inholding priority for acquisition is presented in Chapter 3). Table 2.2 lists the private inholdings offered for exchange, acreage, in order of priority for acquisition.

**Table 2.2 Acreage of Private Inholdings Offered for Exchange under Alternative G, in order of Priority of Acquisition**

| Private Inholding | Acres |
|---|---|
| Lower Basin | 320 |
| Kotzin | 160 |
| TenX | 194 |
| Curley Wallace | 150 |
| Trash Dam | 146 |
| Apex Siding | 160 |
| Anita | 318 |
| Babbitt Tank | 120 |
| East Harbison | 160 |
| Young | 140 |
| Peterson | 156 |
| Willows | 160 |
| ***Total*** | ***2,184*** |

Separate from the land exchange, a special use permit would be issued competitively to a transit provider by the Forest Service and NPS for approximately 60 acres of NFS land to be used for the transit center.

The amount of acres allocated for each use are listed in Table 2.3. Figure 2.6 provides a concept plan that illustrates the proposed location and spatial relationships of the various uses.

**Figure 2.5 Proportion of Uses Within CFV**

based on percent of CFV land area

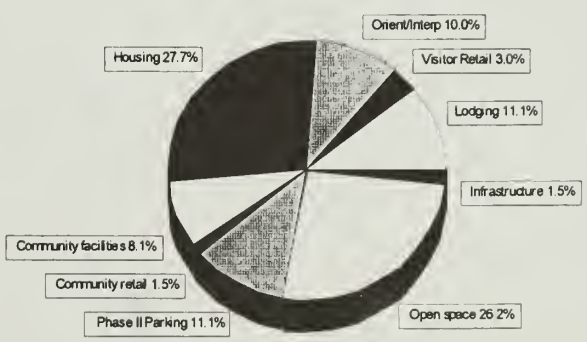
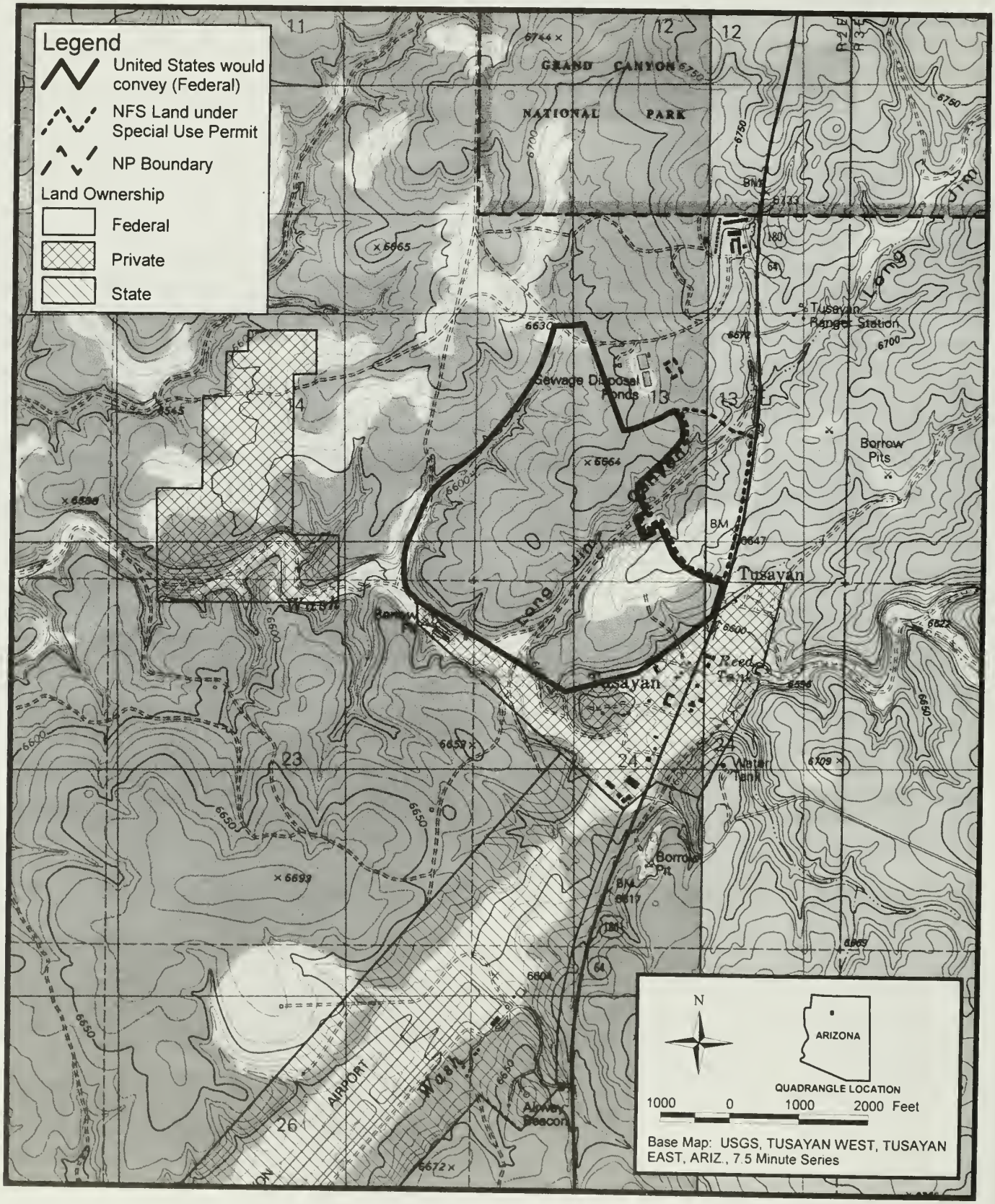


Figure 2.3 Footprint of NFS land involved in Alternative G



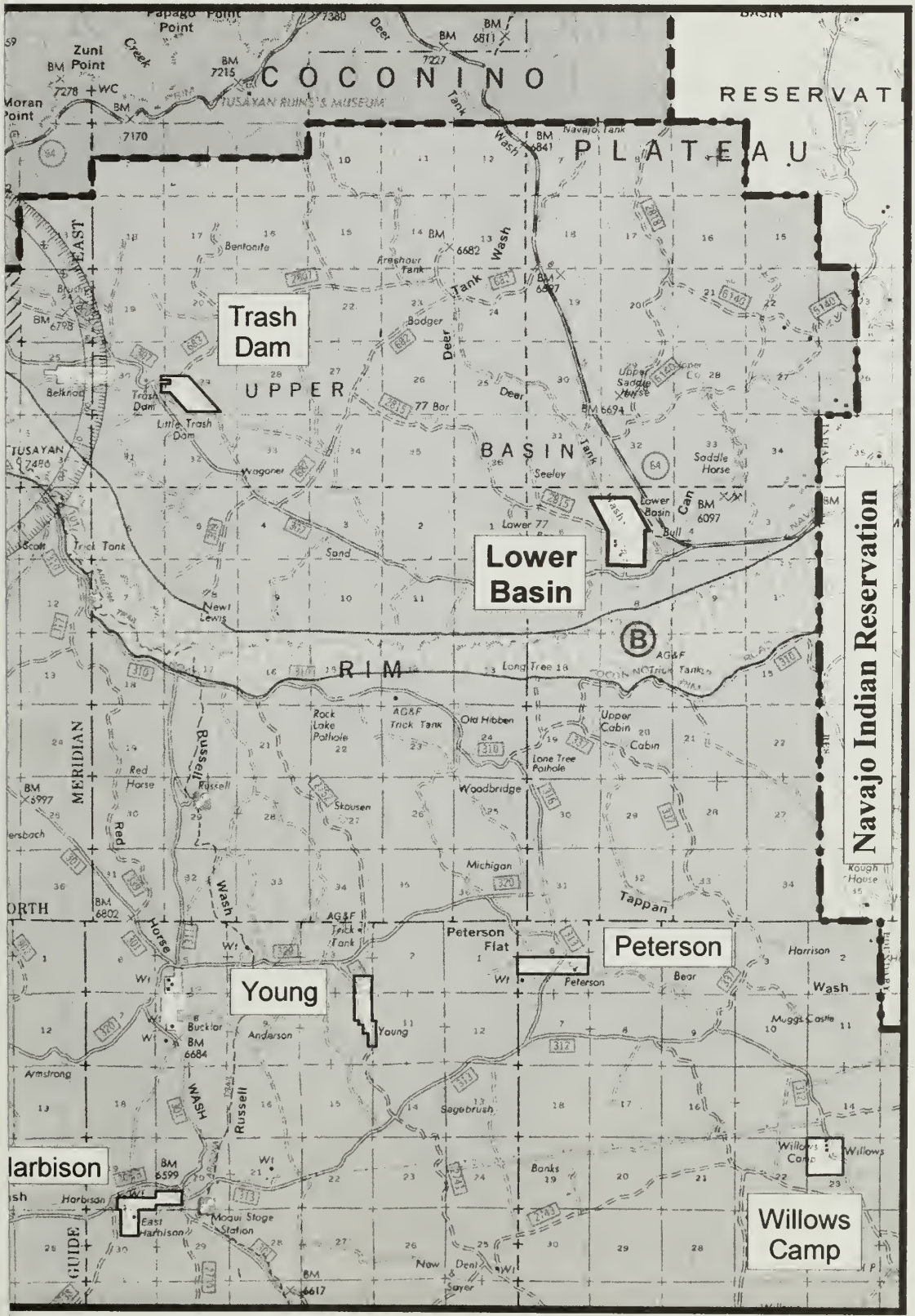

Trash Dam
Lower Basin
Young
Peterson
Willows Camp
Navajo Indian Reservation
COCONINO
PLATEAU
UPPER
BASIN
RIM
Zuni Point
Papago Point
Moran Point
Bentonite
Wagoner
Seeley
Saddle Horse
Lower Basin
Peterson Flat
Harrison
Willows
Harbison
Sagebrush
Woodbridge
Michigan
Tappan
Bear Wash
Russell Wash
Deer Tank Wash
Navajo Tank
Rock Lake Pothole
Old Hibben
Upper Cabin
Lone Tree Pothole
Red Horse
Anderson
Banks
Muggs Castle
Rough House
Long Tree
Sand
Scott
Trick Tank
Little Trash Dam
Belknap
Badger
Deer
Lower 77
Upper Saddle Horse
Cow
Bull
Harbison
East Harbison
Moqui Stage Station
Armstrong
Bucklar
Willows Camp
MERIDIAN
EAST
GUIDE
NORTH

Figure 2.4 Private inholdings offered for exchange in Alternative G

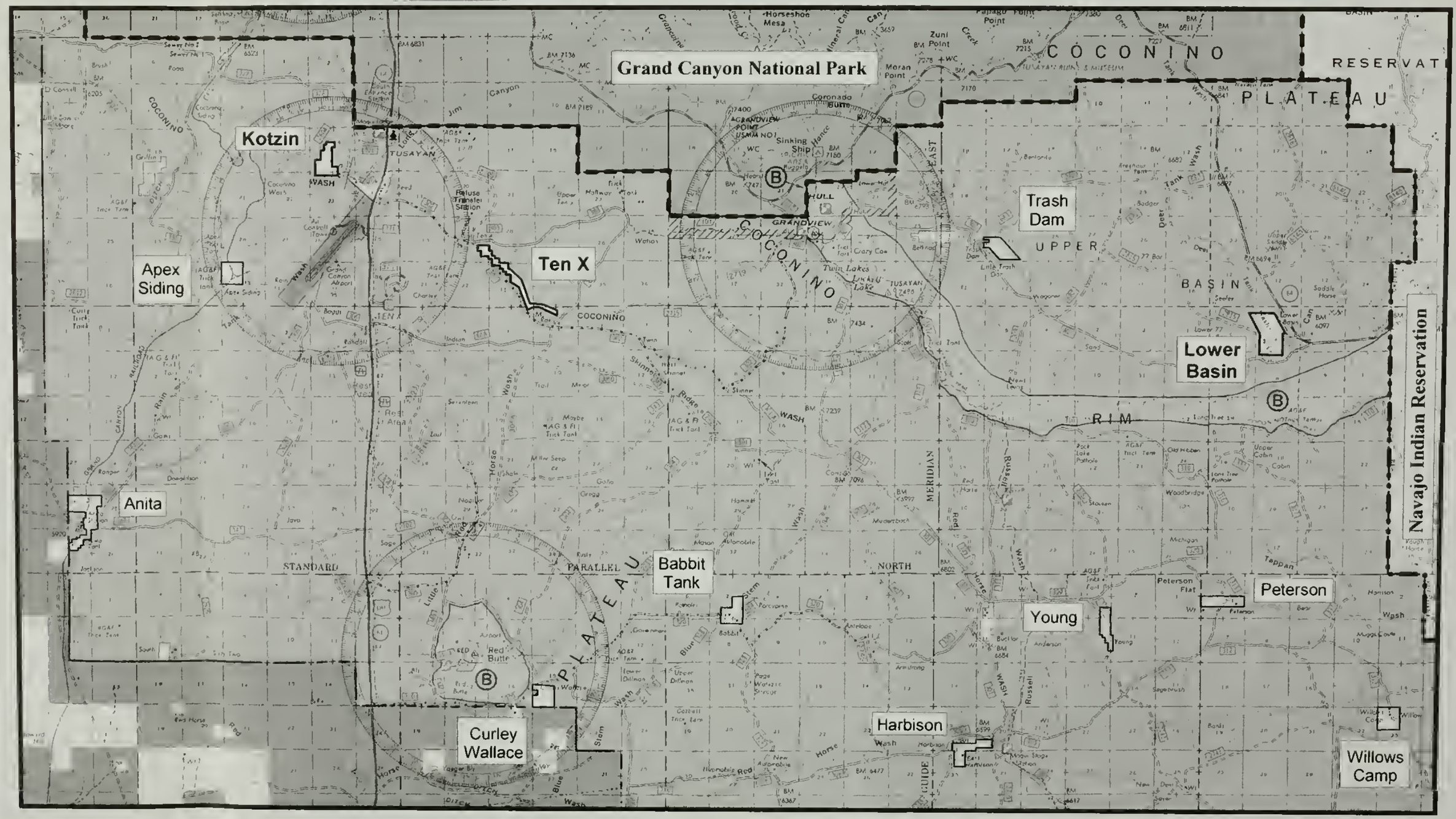


Figure 2.6 Concept Plan for CFV under Alternative G

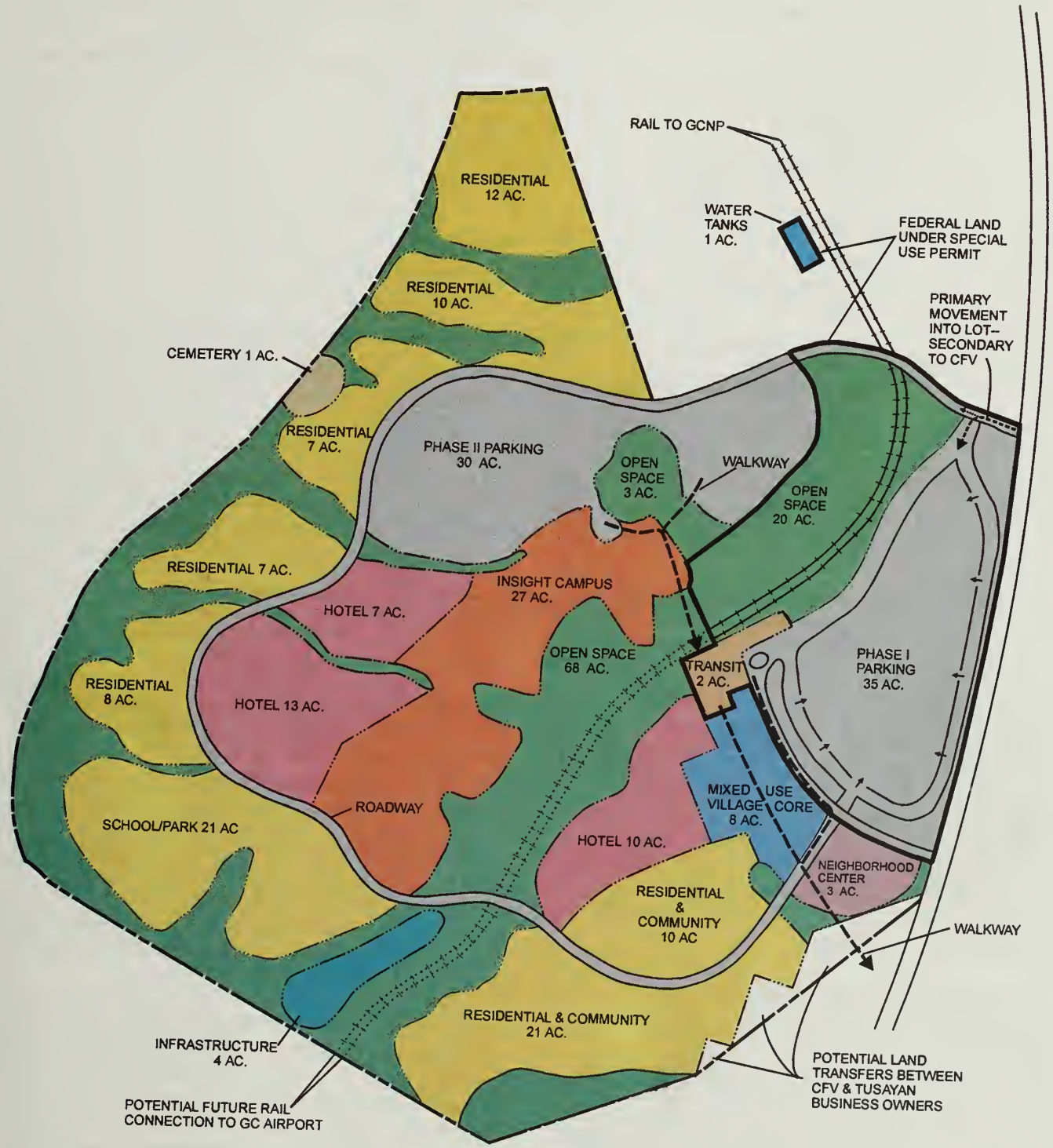


**Table 2.3 Proposed Uses and Associated Acreage of NFS Land in Alternative G**

| Use | Private Land Within CFV | NFS Land Under Special Use Permit |
|---|---|---|
| ***Visitor Segment*** | | |
| Lodging | 30 | — |
| Retail | 8 | — |
| Orientation/Interpretation | 27 | — |
| | 65 | |
| ***Community Segment*** | | |
| Housing | 75 | — |
| Community Facilities | 22[1] | — |
| Retail | 3 | — |
| | 100 | |
| ***Transportation Segment*** | | |
| Transit Center/Phase I Parking | — | 37[2] |
| Phase II Parking | 30 | — |
| | 30 | 37 |
| ***Design Features*** | | |
| Open Space | 71 | 20 |
| Infrastructure | 4 | 1 |
| | 75 | 21 |
| ***Total*** | ***270*** | ***58*** |

1. Some community facilities (e.g., police/fire station, worship centers, community center, etc.) are imbedded in the residential areas
2. Includes a 2 acre transit center

## Visitor Segment

### Lodging and Recreational Facilities

Under this alternative, 900 lodging units would be provided for visitors on 30 acres. No conference lodging, campground, or RV facilities are proposed. If visitation exceeds 6.8 million before the year 2010, CFV could submit requests for additional commercial development beyond the parameters specified in the alternatives for review and approval through Coconino County planning and zoning.

### Visitor Retail and Office/Services

Retail facilities targeted to visitors would include restaurants, shops, and services, comprising no more than 160,000 square feet of improvements on eight acres. Of this amount, approximately 54,000 square feet would be included in INSIGHT. Another 20,000 square feet of office space would be constructed for non-retail services. The types of facilities expected to be established are listed in Table 2.4.

### Orientation/Interpretation

INSIGHT, the proposed experiential, educational, and interpretive center would be developed in conjunction with the Museum of Northern Arizona on 27 acres west of Long Jim Canyon. Certain elements of the campus would be accessed through an entrance fee and operated as profit centers, while other elements would be free to the public as non-profit features and amenities. INSIGHT would provide visitors with information and educational opportunities about natural resources, cultural resources, and the history of Grand Canyon and the Colorado Plateau.

INSIGHT is envisioned as an educational campus that offers a variety of services to visitors to the Grand Canyon region. As visitors arrive to the Grand Canyon area at INSIGHT, they could plan their itinerary in the park and area. They could also learn about the Grand Canyon. This orientation introduces the visitor to the geology, hydrology, wildlife, flora, and cultural history of the park and region.

**Table 2.4 Expected Visitor Retail and Office/Service Facility Types**

| Art Galleries/Crafts | Shops/Commercial | Services |
|---|---|---|
| Western | Hiking Equipment | Tour and Travel |
| American Indian | Bicycle Rental | Day-care Center |
| Natural Resources | Photography | Insurance Agent |
| | Ice Cream and Soda Fountain | Certified Public Accountant |
| | Casual and Fine Dining | Legal Services |
| | Clothing Shops | Bank |
| | Arcade | Service Station |
| | Bookstores and Gift Shops | |
| | Convenience Stores | |
| | Dinner Theater | |
| | Coffee Houses and Boulangerie | |

Having experienced Grand Canyon, visitors would be able to re-experience INSIGHT before leaving the region to learn more about the Grand Canyon region. Facilities at INSIGHT would also serve to educate visitors about other natural and man-made attractions in northern Arizona communities, including Williams, Flagstaff, Page, and the surrounding American Indian communities of Hopi, Navajo, Havasupai, Hualapai, and others.

INSIGHT would have American Indian economic and cultural involvement. Partnership negotiations with the Colorado Plateau tribes are ongoing and include various general and limited partnerships, joint ventures, and tribally-owned businesses.

The Native American Management/Vocational Employment and Support Initiative would provide renewable resources to the tribes most closely associated with Grand Canyon. These resources are in the form of education, employment, cultural empowerment, public access, or actual funds for community improvements.

Exhibits would display information about the traditions of native inhabitants and recent changes that have occurred to their life-styles since European occupation. INSIGHT would provide opportunities for dialogue between visitors and American Indian representatives. Native creation stories may be expressed by traditional religious leaders as well as by contemporary artists. The performance/conference spaces would allow story telling, cultural presentations, research symposia, and powwows.
INSIGHT would have a tiered entry fee system to allow graduated participatory fees from an initial entry fee for an orientation experience to additional fees for more in-depth experiences within interactive learning centers and performance/conference spaces.

In general, this experiential center would consist of a cluster of pavilion-like, interconnected facilities, encompassing approximately 330,000 square feet of exhibit space, integrating state-of-the-art exhibits and technology with outdoor interpretive experiences. Once on the grounds, all paths would lead to the Orientation Pavilion to preview INSIGHT's attractions. Key aspects of INSIGHT's programs and hospitality services would be multilingual. Visitors could purchase tickets to GCNP, shop in theme-based retail outlets, sample regional cuisines, and take advantage of on-site trip planning and booking services for the entire Colorado Plateau region.

Through multimedia laser presentations, theaters, and exhibits, visitors would experience four themes: Canyon Dreams (the place), Desert Realms (the context), Sojourners (the people), and Sky Mysteries (the spirit). The services and facilities that are proposed for INSIGHT are listed in Table 2.5

INSIGHT would include a American Indian training facility for career-oriented employment skills within hotel, food service, security, facilities supervision, activity interpretation, human services, computer and

**Table 2.5 Facilities at the Proposed INSIGHT Center**

| Public | Administrative | Retail/Food & Beverage |
|---|---|---|
| *Facilities* | | |
| Parking | Registration and collections management | Theme-based Bookstore |
| Main Public Lobby | Exhibit Preparation Area | Theme-based Giftshop |
| Orientation Theaters | Administrative Offices | Art Gallery |
| Exhibition Galleries | Cultural Resources | Restaurants |
| Resource Center | Community Meeting Room | |
| Theater | Human Services & Staff Facilities | |
| Conference Center | Central Data & Communication | |
| Restrooms | Shipping & Receiving Facilities | |
| | Building Management Services | |
| *Features Incorporated into Design* | Security Services | |
| Public Transportation Access | | |
| Pedestrian Educational Trails | | |
| Hiking & Picnic Areas | | |
| Indigenous Plants & Natural Areas | | |
| Public Art | | |

information services, environmental and cultural preservation, transportation administration, and cooperative federal agencies. Funding assistance for trainees, housing, and transportation subsidies would be available to enable full participation by American Indians.

Orientation information associated with the Grand Canyon Transit Center would be identical to that described under Alternative F. Please refer to that section in this chapter for details.

## Community Segment

### Residential

To serve its own employees, CFV would build and manage an estimated 434 housing units, composed of apartments, dormitories, and townhomes. In addition, CFV would initially provide 50 trailer/manufactured home pads on 10 acres for lease to area residents at market rates. Finally, CFV would lease 20 acres of improved land to the NPS at market rate for park concessionaire and/or NPS employee housing. No vacation or second homes would be permitted within the CFV development.

### Community

CFV would donate 21 acres of improved land (road access and basic utility infrastructure) to the Grand Canyon School District for a school. Additionally, improved land or building space would be available for sale or lease for a medical clinic, library, cemetery, fire/police station, post office, and worship centers. In addition, CFV would construct and manage a 4,000 square foot community center with a kitchen, meeting room and restrooms. Playgrounds and open areas available for public use would be imbedded in residential areas.

### Community Retail

Community retail would serve both area residents and park visitors and would total not less than 40,000 square feet. The types of retail facilities expected to be established are summarized in Table 2.6. The proposed mix of services and products would accommodate most routine retail needs of area residents.

**Table 2.6 Community Retail and Commercial Facilities**

| Services | Retail |
|---|---|
| Laundromat | Hardware |
| Service Station | Pharmacy |
| Video | Convenience Store |
| Day-care | Grocery Store |

## Transportation Segment

### Transportation Staging Area

Under this alternative, the Grand Canyon Transit Center and Phase I parking would be constructed and operated as described under Alternative F by the transit provider. Please refer to those sections in this chapter for details. Because CFV village core retail and lodging guests would also use Phase I parking, construction of another parking facility would be necessary. Phase II parking would include 30 acres of parking on private land, built and managed by CFV. The number of parking spaces in Phase II would be determined by Coconino County through the zoning process. A 60 foot-wide corridor in Long Jim Canyon heading south from the transit center to the private property boundary of Tusayan would be reserved for a potential future rail connection to Grand Canyon Airport.

### Trails and Foot Paths

The transit provider would build a pedestrian sidewalk from the transit center to the IMAX theater on NFS land adjacent to the Phase I parking, as described under Alternative F. CFV would build a pedestrian corridor from the transit center through the village core to the IMAX theater. The corridor through the CFV village core would be 50 to 100 feet-wide with native landscaping and small public gathering areas. Lateral walkways would connect the corridor to businesses and pedestrian sidewalks within the CFV village core. The pedestrian corridor could continue through Tusayan, linking Tusayan lodging and retail businesses with the transit center and CFV village core. An internal pedestrian/bike trail system through CFV would eventually link to GCNP and Tusayan.

### Roadway Improvements

The transit provider would be responsible for making necessary improvements to State Highway 64 to access the transit center and for maintaining all roads within the special use permit boundary. CFV would be responsible for all roads within the CFV development.

## Architecture Design, Site Planning, Sustainable Elements, and Resource Conservation

Architecture design features define the character, aesthetics, structure, and function of the development. Site planning includes a description of how existing topography, vegetation, soil removal, and drainage would be incorporated into the design, as well as explaining the amount of open space and type of night-lighting proposed. Sustainable elements include components with the ability to sustain diversity, productivity, resilience to stress, health, renewability, and/or yields of desired values, resource uses, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time. Resource conservation includes a discussion of the types of measures proposed to conserve resources (e.g., energy). All of these features (design, planning, conservation, and sustainable elements) are interrelated.

### Architecture Design

Architectural design of the transit center and structures within the CFV development would follow the GCNP Architectural Character Guidelines. Building materials would consist primarily of wood with native stone used to the extent possible. Colors for buildings and facilities would be compatible with the existing natural surroundings.

### Site Planning

This alternative strives to incorporate several sets of ideas for community planning and design that are known as the Ahwahnee Principles (California Local Government Commission 1991). The following Ahwahnee Principles form the basis for the site planning and design of CFV under Alternative G:

- Site planning is based on the objective of achieving a complete and integrated community that contains housing, shops, work places, schools, parks, and civic facilities essential to the daily life of residents.
- The size of the community places housing, jobs, daily needs, and other activities are within easy walking distance of each other.
- As many activities as possible are located within easy walking distance of transit stops.
- A diversity of housing types is provided to accommodate citizens from a wide range of economic levels and age groups.
- Businesses within the community provide a range of job types for the community's residents.

- The location and character of the community is consistent with a larger transit network.

Under this alternative, 71 acres or approximately 26% of the CFV land area would be dedicated open space. Long Jim Canyon would remain essentially undeveloped, with the rail system constructed within and adjacent to the existing roadway. Open space would consist of designated natural corridors and other greenways connecting various parts of the development. Buildings would be appropriately spaced and walkways would be created to provide additional, specialized open space within the development. Natural areas of ponderosa pine and other native vegetation would be retained within the transit center parking area and within the CFV development to maintain a natural setting.

Night lighting would be accomplished by using conventional street lights, and would conform to the provisions of the Coconino County Lighting Ordinance for Zone III as specified in the Tusayan Area Plan and Coconino County Zoning Ordinance.

### Sustainable Elements

Building materials, waste management, landscaping and exterior design, resource conservation, and specialized open spaces adopt standard materials, practices, and components. Sustainable elements would be incorporated in development practices when the benefits outweigh the costs. Sustainable Design Elements are is described in Table 2.8.

### Resource Conservation

The Tusayan Area Plan and Coconino County Comprehensive Plan would guide resource conservation and waste minimization efforts. A curb-side recycling program would be established for the development. Water conservation would meet county regulations for use of low-flow fixtures for flush toilets, urinals, and lavatories in the employee housing units and in the transit center. Low-flow showerheads and faucets would also be installed in employee housing units, as required by the Tusayan Area Plan. Nonpotable water obtained from the wastewater treatment facilities and water harvesting off the Phase 1 parking lot, and would be used for flushing toilets and irrigation.

Energy conservation would include building placement and design to take advantage of opportunities for passive solar heating and use of building materials to reduce energy consumption with cost as a primary consideration.

## Infrastructure

### Water

An estimated average of 48 mgy of potable water would be required to maintain the community, retail, and residential segments of CFV under normal water conservation measures. The transit center would use an additional 2 mgy of potable water.

Groundwater from an existing well in Valle would be the primary source of water. In its current state, the existing well in Valle has the capacity of providing 47 mgy. An additional 1 mgy of water could be provided by 1) retrofitting the existing well in Valle to increase the capacity of this well, 2) providing additional on-site storage capacity to accommodate peak season demands, 3) purchasing water from the GCNP water system, and 4) purchasing water from outlying communities. Water demand could also be reduced by implementing additional water conservation measures funded through the Kaibab Institute. Water purchased from the GCNP system and outlying communities would serve as a supplemental water source and an emergency water source. Groundwater withdrawn from Valle would be capped at 48 mgy through a voluntary agreement with the Forest Service, NPS, Coconino County, and CFV. A constant rate of 91 gallons per minute (gpm) would be required to supply 48 mgy. The pumping rate would vary based on seasonal water demands, particularly during the peak season.

Normal water conservation measures to be implemented under this alternative include landscape irrigation with reclaimed wastewater (nonpotable), xeriscaping, collection of water from parking lots, and dual-plumbing of visitor lodging, the transit center, and multi-family residences for toilet flushing with reclaimed wastewater. The use of nonpotable water for toilet flushing and irrigation would reduce the overall demand for potable water.

The transit provider would harvest approximately 5 mgy of nonpotable water from the Phase I parking lot for toilet flushing and irrigation. Any remaining water would be discharged as required by the stormwater discharge permit or made available to other users. Water could also be collected from the Phase II parking for nonpotable uses.

### Energy

Most energy needs would be met using traditional systems. Energy conservation would be achieved by manufactured applications, building envelopes, natural heating and cooling systems, and energy-efficient equipment and appliances. Conventional electricity would be the main energy source, supplied by APS. All utilities would be buried. Natural gas or liquefied natural gas (LNG) may also be used. Passive solar elements would be incorporated into the architectural design of buildings when benefits exceed cost.

### Solid Waste Management

Solid waste would be hauled to the City of Flagstaff landfill by a private contractor, unless a regional solid waste facility is established closer to Tusayan. Solid waste would be reduced through collection and marketing of basic recyclable materials. A curb-side recycling program would be implemented in the CFV development and transit center.

### Wastewater Management

The CFV development and transit center would tie into the existing SGCSD wastewater treatment facility or a new conventional wastewater treatment plant would be constructed in CFV. Reclaimed water for use in irrigation and toilet flushing would be obtained from the SGCSD facility or from the CFV treatment plant, if constructed. Lodging units and multi-family housing units would be dual-plumbed to make use of reclaimed water, reducing potable water demand.

## Project Implementation

### Governance

Development and operation of the transit center would be under the terms and conditions of the special use permit and agreements with Forest Service and NPS.

Development densities and phasing would be enforced though agreements with Coconino County. A comprehensive development agreement between CFV and Coconino County would be used to ensure achievement of development densities and phasing. Coconino County would be responsible for enforcement of the development agreement and associated conditions of county approval, as it is for other developments within Coconino County.

Two separate funding mechanisms are proposed for the governance entity. One source would finance the administration and enforcement of the covenants, conditions, and restrictions (CC&Rs). The other source would finance the environmental functions.

**Kaibab Institute**

An independent, non-profit entity, the Kaibab Institute (Institute), would play an essential role in implementing the plan for the CFV development.

The Institute would be the entity responsible for community governance in the development. The Institute would carry out its activities through a board of directors, potentially composed of commercial property owners within the development; environmental organizations; and through committees composed of property owners, residents, and others. Local and federal agency representatives would serve in an advisory capacity to the board of directors.

The Institute would administer and enforce the CC&Rs that apply to the property and govern such issues as architectural control, use restrictions, and maintenance of any open space or other "common area." The CC&Rs would run with title to all property in the development. The CC&Rs would establish a general plan of development, a procedure to ensure that all new construction and modifications to existing structures and completed lots are consistent with the plan of development, a minimum maintenance standard for all property within the development, and assessment obligations and procedures. The CC&Rs would also provide that the Institute would own and maintain the common property in the development and would have the authority to enforce the provisions of the CC&Rs.

To ensure uniform architectural standards, CFV would prepare design guidelines based on the Grand Canyon National Park Architectural Character guidelines,

describing the general architectural standards for the community. The design guidelines may vary for different lots according to proposed use, location, and special conditions. They would include specific requirements regarding areas of particular concern, such as setbacks, building height, impact on the natural environment, driveways, and garages. The design guidelines may also list suggested materials for construction and landscaping. In addition, the design guidelines may set standards for the construction process, such as when construction must begin and be completed and appearance of the construction site.

Initially, CFV would have the authority to review and approve all applications for new construction and landscaping or modifications to existing structures or landscaping to ensure that the development plans are firmly established. As development progresses, CFV would transfer its responsibility for reviewing applications for construction or modifications to an architectural review committee appointed by the Institute.

The CC&Rs would also establish a framework for the creation of standards governing an owner's, lessee's, or resident's use and maintenance of, as well as conduct upon, any lot located within the development. The provisions would be structured to allow for some initial determinations regarding permitted uses of lots and accompanying standards and to allow the Institute to modify these use restrictions and rules as the needs of the community unfold. The CC&Rs may also include a list of specific rights of owners, lessees, and residents that cannot be altered to protect essential rights of owners, lessees, and residents. In addition, the CC&Rs would include restraints upon the leasing and ownership of property.

All residences in the development, including those residences constructed on CFV-owned land leased to others, must be occupied by at least one person who is a "resident" or "qualified renter." A resident is a person who lives within the development all 12 months of the year and who is employed in GCNP, in the CFV development, or in the Tusayan Ranger District of KNF, including unincorporated areas of Tusayan and other privately owned areas within the district. A qualified renter is an individual who is employed within the CFV development, GCNP, or the Tusayan Ranger District, for as long as they remain in such employment. The CC&Rs would empower the Institute to grant exceptions to resident and renter requirements in hardship situations.

In the event that a property owner, lessee, or resident violates the use restrictions and rules, the Institute would have the authority to enforce various sanctions, which may include levying fines, suspension of rights, suspension of services provided by the Institute, and, if necessary, correcting the violation and charging the property owner for any costs.

The Institute would also have the responsibility for maintaining the community's common areas. Responsibilities may include maintenance of common property in the development, upkeep of storm water retention and drainage systems, maintenance of pedestrian and bike pathways, and, to a limited extent, landscaping and lighting.

Funding for the Institute's governance expenses would be raised primarily through annual base assessments charged to all commercial property owners. The amount of each year's assessment would be determined by the Institute by dividing its budget expenses among all property owners pursuant to a formula. Residential property lessees may pay the same annual base assessment. Commercial property may have a variable base assessment rate tied to square footage, gross revenue, or some other verifiable standard. Property owners would not be able to exempt themselves from the obligation to pay assessments by nonuse of the common property.

The Institute also may collect neighborhood assessments, special assessments, and specific assessments. Neighborhood assessments are charged to all property owners, lessees and residents in a distinct "neighborhood" to pay for a special service provided by the Institute, such as exterior maintenance, or maintenance of special facilities, such as covered parking, that is not offered or available to other property owners, lessees, and residents in the development. In addition, property owners, lessees, and residents in a neighborhood may request that the

Institute provide a special service and charge the cost as a neighborhood assessment.

The Institute may, with input from the property owners and lessees, levy special assessments to cover unbudgeted expenses such as capital improvements. The Institute may also levy special assessments against individual property owners and lessees who do not comply with the restrictions to pay for the cost of correcting nonconforming conditions (e.g., removing accumulated trash) or who request a special service offered by the Institute (e.g., exterior maintenance).

In addition to assessments, other funding sources for the Institute may include user fees, special event fees, and transfer fees. User fees would be charged if a resident or non-resident of the community wants to use specific services or facilities. Special event fees would be charged to the sponsor of a special event for the use of facilities, services, or areas within the development during the event. The closing of a sale or transfer of any property within the CFV development may result in payment of a transfer fee by the seller to the Institute.

**Environmental Preservation Organization**
The Institute would also ensure that environmental commitments are enforced and would establish a permanent revenue source at 0.1% of gross revenues to carry out its environmental functions. Based on revenue projections for Alternative G, annual funding for the Institute's environmental functions would range from $116,000 in year one to $151,000 in year 10. The Institute's environmental mission is to realize the long-term conservation and community priorities in the area, including the enforcement of mitigation measures outlined in this EIS.

The primary environmental functions of the Institute would be to preserve and enhance the natural environmental setting within and surrounding the development through a wide range of programs and partnerships, including public education, acquisition of land or conservation easements, ecological restoration and various other activities. This could include the following responsibilities:

- support or carry out long-term ecological and archeological monitoring and research to evaluate the long-term impact of development in the region and the effectiveness of mitigation measures.
- carry out long-term cross-boundary ecological restoration and conservation projects around KNF and GCNP (e.g., wildlife management measures, particularly those related to development impacts)
- provide start-up funding and ongoing support for programs to acquire land or conservation easements in the region for ecological and scenic purposes, prepare environmental guidelines for incorporation into the CC&Rs to address architectural standards, construction materials, landscaping, water and energy conservation, and other sustainable design technologies
- promote long-term implementation and maintenance of commitments to water conservation, native plant landscaping, energy efficiency and conservation, soil erosion, air quality, excessive lighting, noise, exotic animal problems, wildlife conservation, recycling, and other sustainability features
- manage and maintain a system of multi-purpose trails within and around the gateway development to link the development with GCNP and other community facilities
- in coordination with INSIGHT, have primary responsibility for environmental education targeted to visitors, school children, and residents and property owners in the development

The Institute would carry out these activities within and surrounding the CFV development and offsite, depending on the availability of funds, to address the regional impacts of the development.

### Project Cost
This alternative would be funded through private investments. Construction cost for this alternative is estimated to be $17 million for the transit center and approximately $217 million for the visitor retail/ residential/community segment.

### Implementation schedule
The implementation of this alternative revolves around the need to build visitor services and facilities that generate income so other aspects of the alternative that

require subsidy (infrastructure and community facilities) can be built. The transit center would be constructed within the first year. In the visitor segment, all of the lodging (900 units) and retail (200,000 square feet) facilities would be constructed in the first year. Like the visitor segment, housing components of the community segment would be phased to keep pace with housing demands from an increased employment base. Improved land would be made available for lease to NPS for NPS and park concessionaire housing in the first year of operation. The proposed community center would be constructed in the first year. CFV would construct the neighborhood retail center in the first few years of operation. Lots or building space for the house(s) of worship, post office, library, and medical facility would be made available for sale or lease in the first year of operation. A school site with infrastructure would be developed and donated to the school district in the first year.

## Alternative H

### Introduction

Alternative H is the proponent's response to the ID Team-designed Alternative G. Many components of these two alternatives are identical; however, Alternative H differs in two key areas. First, Alternative H does not use groundwater; and second, CFV under Alternative H is proposed as a model gateway community, sustainably built and operated. The elements of sustainability are described in the Sustainable Elements section and in Table 2.8. Higher levels of retail and lodging to support the costs of those features. This alternative was designed to incorporate ideas of self-sufficiency, efficiency of use, durability of materials, resource conservation, and aesthetics. This alternative allows for acquisition of the private inholdings, reduces the amount of commercial development over Alternatives B and C, and allows for a transit center to be built independently of other aspects of this alternative.

The proponent for this alternative is CFV. Through the land exchange, CFV would acquire 272 acres of NFS land, north of Tusayan and west of State Highway 64 (Figure 2.7). This land would be used to construct a gateway community to GCNP. The function of this community would be to provide visitor services and facilities outside GCNP, alleviating pressures on the park caused by increased visitor demand; provide housing for area employees, alleviating pressures to build more employee housing in the park; provide an improved land base for community facilities, providing an opportunity for the development of community facilities to serve residents of Tusayan, GCNP, and CFV; and develop INSIGHT, an experiential, educational and interpretive center, expanding the educational and interpretive experience of GCNP visitors.

In return the Forest Service would acquire private inholdings in the Tusayan Ranger District that are equal to the value of the NFS land traded to CFV (see Figure 2.4). Private inholdings would be acquired in order of highest priority as explained under Alternative G.

Separate from the land exchange, a special use permit would be issued competitively to a transit provider by the Forest Service and NPS. Approximately 60 acres of NFS land would be available for the transit center.

Development would include three primary components: (1) a visitor segment; (2) a community segment; and (3) a transportation segment. Figure 2.8 illustrates the proportion of proposed uses of NFS land.

The amount of acres allocated for each use are listed in Table 2.7. Figure 2.9 provides a concept plan that illustrates the location and spatial relationships of the various uses.

**Figure 2.8 Proportion of Uses Within CFV**

based on percent of CFV land area

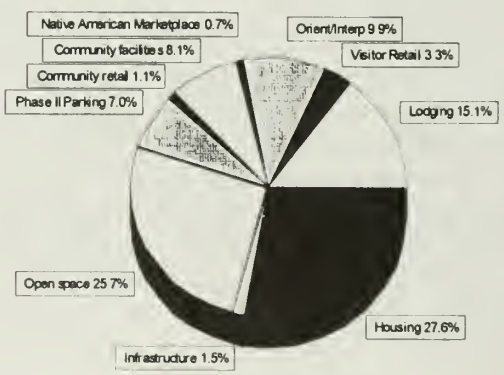


Figure 2.7 Footprint of NFS land involved in Alternative H

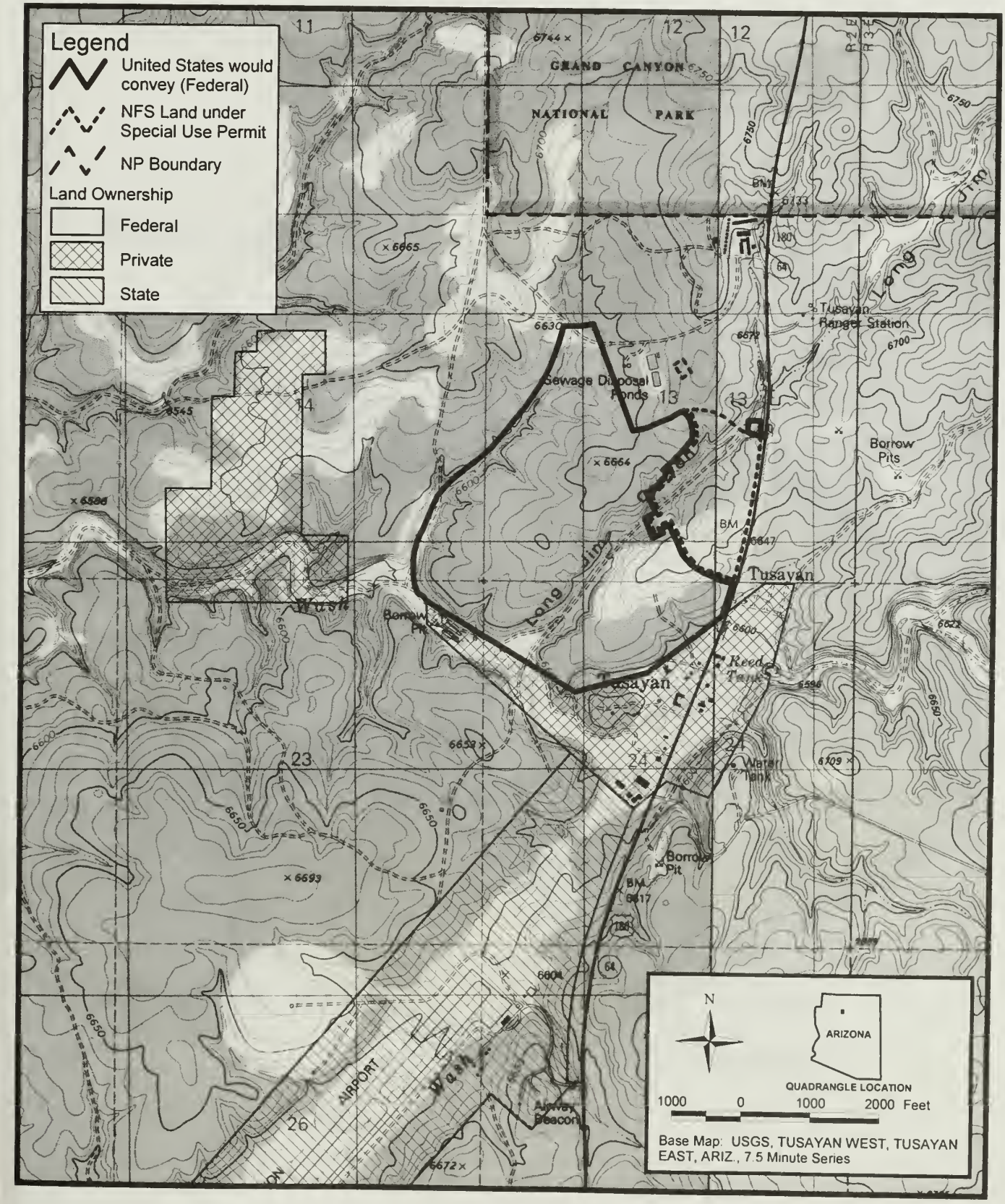


Figure 2.9 Concept Plan for CFV in Alternative H

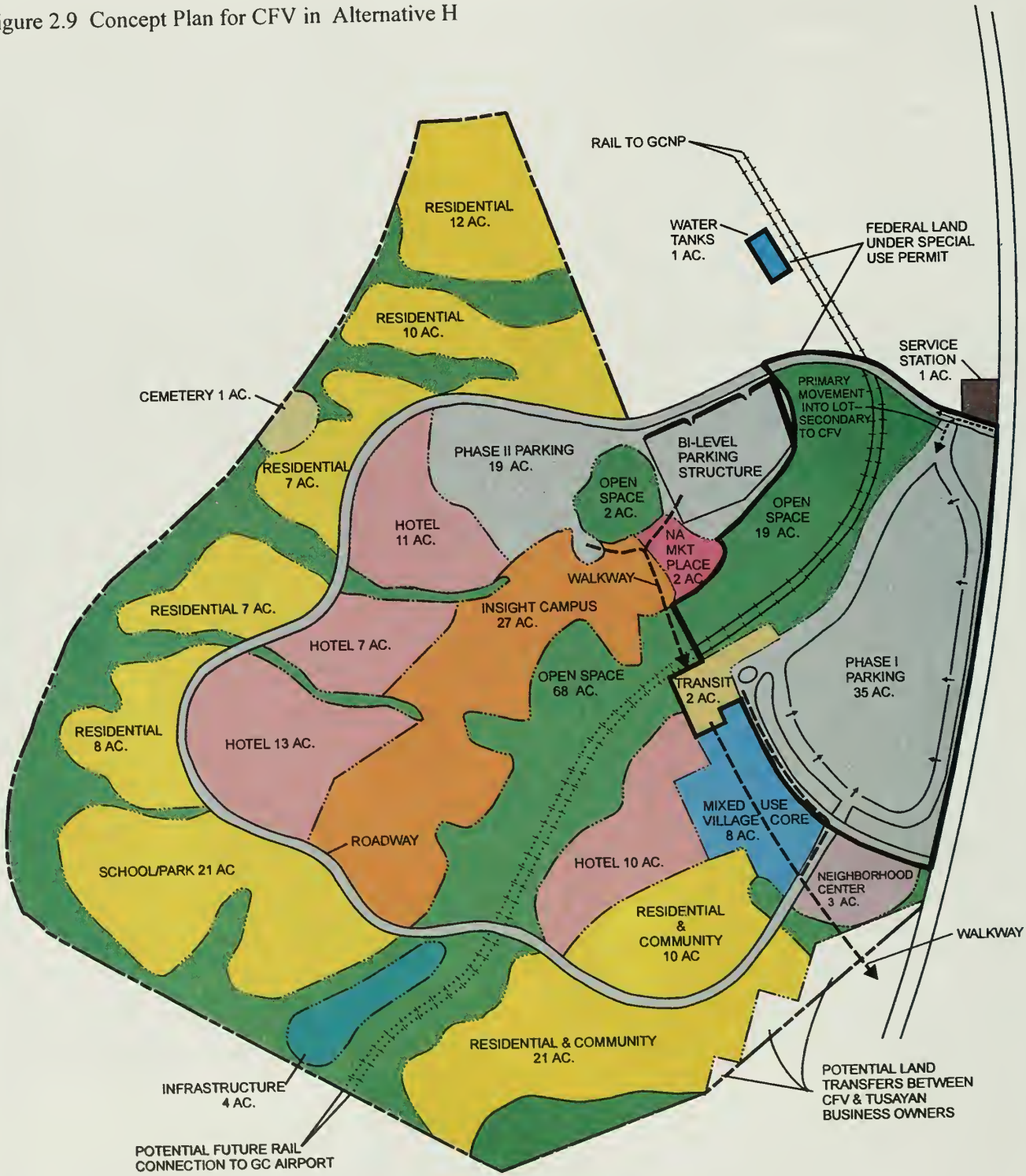


**Table 2.7 Proposed Uses and Associated Acreage of NFS Land in Alternative H**

| Use | Private Land Within CFV (nearest acre) | NFS Land Under Special Use Permit (nearest acre) |
|---|---|---|
| ***Visitor Segment*** | | |
| Lodging | 41 | — |
| Retail | 9 | — |
| Orientation/Interpretation | 27 | — |
| Native American Marketplace | 2 | |
| | 79 | |
| ***Community Segment*** | | |
| Housing | 75 | — |
| Community Facilities | 22[1] | — |
| Retail | 3 | — |
| | 100 | |
| ***Transportation Segment*** | | |
| Transit Center/Phase I Parking | — | 37[2] |
| Phase II Parking | 19[3] | — |
| | 19 | 37 |
| ***Design Features*** | | |
| Open Space | 70 | 19 |
| Infrastructure | 4 | 1 |
| | 74 | 20 |
| ***Total*** | ***272*** | ***57*** |

1. Some community facilities (e.g., police/fire station, worship centers, community center, etc.) are imbedded in the residential areas
2. Includes a 2 acre transit center
3. Includes an 8-acre bi-level parking structure

## Visitor Segment

### Lodging and Recreational Facilities

Under this alternative, 1,220 lodging units would be provided for visitors on 41 acres. In addition, 50 hostel-type beds would be included in Alternative H. No conference lodging, campground, or RV facilities are proposed. If visitation exceeds 6.8 million before the year 2010, CFV could submit requests for additional commercial development beyond the parameters specified in the alternative for review and approval through Coconino County planning and zoning.

### Visitor Retail

Retail facilities targeted to visitors would include restaurants, shops, and services and would comprise approximately 210,000 square feet of improvements on eight acres. A portion of this retail, approximately 54,000 square feet would be within INSIGHT. Another 20,000 square feet of office space would be constructed for non-retail services. The types of facilities expected to be established are the same as Alternative G, (see Table 2.4).

In addition to typical visitor retail, a 20,000 square-foot Native American Marketplace would be constructed on 2 acres adjacent to the Phase II parking and INSIGHT. The marketplace would include a common indoor/outdoor market for cultural wares and traditional foods. CFV would build the marketplace and donate the facility to an organization like Native Americans for Community Action (NACA) at no cost to NACA. Revenue above the NACA management fee would be retained by involved entrepreneurs.

### Orientation/Interpretation

As CFV under Alternative H is a demonstration site for sustainable design, INSIGHT would be expanded to become a demonstration/education center for environmental sustainable development applications throughout the CFV development. Active and passive energy systems, efficient use of building materials, indoor air quality and other commitments under the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED™) would be integrated into INSIGHT.

## Community Segment

### Residential

To serve its own employees, CFV would build and manage an estimated 517 housing units, composed of apartments, dormitories, and townhomes. CFV would also initially provide 50 townhomes and garden units for sale or lease to area residents at market or subsidized rates. Finally, CFV would lease 20 acres of improved land to NPS at market rate for NPS and/or concessionaire employee housing. No vacation or second homes would be permitted in the CFV development.

### Community

CFV would donate 21 acres of improved land to the Grand Canyon School District for a school. Additionally, improved land or building space would be available for sale or lease for a medical clinic, library, cemetery, post office, and worship centers. A fire station would be built, equipped, and donated to the Tusayan Fire District, and a police substation would be built, equipped, and donated to Coconino County. In addition, CFV would construct and manage a 4,000 square foot community center with a kitchen, meeting room and restrooms. Playgrounds and open areas available for public use would be imbedded in residential areas.

### Community Retail

Community retail would serve both area residents and park visitors and would entail up to 40,000 square feet. The types of retail facilities expected to be established are the same as those described in Table 2.6.

## Transportation Segment

### Transportation Staging Area

The Grand Canyon Transit Center and Phase I parking would be constructed and operated as described under Alternative F by the transit provider. Please refer to those sections in this chapter for details. Because CFV village core retail and lodging guests would also use Phase I parking, construction of another parking facility would be necessary. Phase II parking would include 19 acres of parking with an at-grade or architectural bi-level parking structure on private land, built and managed by CFV. The number of parking spaces in Phase II would be determined by Coconino County through the zoning process. A 60 foot-wide corridor in Long Jim Canyon heading south from the transit center to the private property boundary of Tusayan would be reserved for a potential future rail connection to Grand Canyon Airport.

### Trails and Foot Paths

The transit provider would build a pedestrian sidewalk from the transit center to the IMAX theater on NFS land adjacent to the Phase I parking, as described under Alternative F. CFV would build a pedestrian corridor from the transit center through the CFV village core to the IMAX theater. The corridor through the CFV village core would be 50 to 100 feet-wide with native landscaping and small public gathering areas. Lateral walkways would connect the corridor to businesses and pedestrian sidewalks within the CFV village core. The pedestrian corridor could continue through Tusayan, linking Tusayan lodging and retail businesses with the transit center and the CFV village core. An internal pedestrian/bike trail system through CFV would eventually link to GCNP and Tusayan.

### Roadway Improvements

The transit provider would be responsible for making necessary improvements to State Highway 64 to access the transit center and for maintaining all roads within the special use permit boundary. CFV would be responsible for all roads within the CFV development.

## Architecture Design, Site Planning, Sustainable Elements, and Resource Conservation

Architecture design features define the character, aesthetics, structure, and function of the development. Site planning includes a description of how existing topography, vegetation, soil removal, and drainage would be incorporated into the design, as well as explaining the amount of open space and type of night-

lighting proposed. Sustainable elements include components with the ability to sustain diversity, productivity, resilience to stress, health, renewability, and/or yields of desired values, resource uses, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time. Resource conservation includes a discussion of the types of measures proposed to conserve resources (e.g., energy). All of these features (design, planning, conservation, and sustainable use) are interrelated.

### Architecture Design

Design of the development under this alternative would conform to guidelines set forth by LEED™ and the GCNP Architectural Character Guidelines. Materials such as natural stone and wood products would be used.

### Site Planning

This alternative strives to incorporate several sets of ideas for community planning and design that are known as the Ahwahnee Principles (California Local Government Commission 1991). The following Ahwahnee Principles form the basis for the site planning and design of CFV under Alternative H:

- Site planning is based on achieving a complete and integrated community that contains housing, shops, work places, schools, parks, and civic facilities essential to the daily life of residents.
- The size of the community places housing, jobs, daily needs, and other activities are within easy walking distance of each other.
- As many activities as possible are located within easy walking distance of transit stops.
- A diversity of housing types is provided to accommodate citizens from a wide range of economic levels and age groups.
- Businesses within the community provide a range of job types for the community's residents.
- The location and character of the community is consistent with a larger transit network.

Under this alternative, 70 acres or approximately 26% of the total land area would be dedicated open space. Open space would consist of designated natural corridors and other greenways connecting various parts of the development. Buildings would be properly spaced and walkways would be created to provide additional open space in the development. CFV would relocated trees less than 8 feet tall and would plant one tree for every 1,000 square feet of impervious surface.

Night lighting would be accomplished by using sky shields and low-level fixtures, and would conform to the provisions of the Coconino County Lighting Ordinance for Zone II (similar to that around an observatory), providing a 50% reduction in night-lighting over Alternatives F and G.

### Sustainable Elements

CFV has committed to many performance criteria to achieve the silver rating under LEED™. The LEED™ rating system is described in the Sustainable Design Elements section, preceding Table 2.8. Highlights of these criteria in Alternative H are listed below.

- Water Conservation: CFV would install maximum water conservation fixtures.
- Water Recovery System: CFV would reuse nonpotable water on a community wide level as required by the Tusayan Area Plan. Water would be harvested from buildings, parking lots, and other impervious structures.
- Water Conserving Cooling Towers: Depending on availability, nonpotable water may be used in cooling towers. Conservation mechanisms, like delimiters, may be added.
- Renewable/Alternative Energy Sources: CFV would commit to providing 10% of their estimated power requirement through alternative energy resources like passive and active solar systems.
- ASHRAE Standard 90.1-1989: CFV would exceed these standards by 40% or more in CFV.
- Surface Runoff/Filtration: Water harvested from parking areas and buildings would be treated for potable use.
- Biological Waste Treatment: A biological wastewater treatment system would be used instead of a conventional wastewater treatment system that uses chemicals and produces sludge.
- Construction Site Management: CFV would limit construction disturbance to 50 feet beyond building perimeter for earthwork.
- Revegetation: CFV would relocate trees less than 8 feet tall that are within building disturbance areas. CFV would plant one tree for every 1,000 square feet of impervious surface.
- Alternative Fuel Vehicles: CFV administration would use alternative-fueled vehicles and install refueling facilities for alternative-fueled vehicles.
- Waste Management: CFV would commit to a 75% recycling diversion rate.

- Indoor Air Quality: CFV would install permanent air monitoring systems in lodging facilities and at INSIGHT.

### Resource Conservation

Electric energy systems would be supplemented by active and passive solar systems that provide a minimum of 10% of the total power needs. This could amount to as much as 1.3 megawatts of solar photovoltaic electricity. CFV facilities would be constructed with improved windows, walls, roofs, and building envelopes to conserve energy. The CFV development would exceed ASHREA standards in all development by 40%. ASHREA is an energy standard, in codified form, which evaluates all energy uses within a building envelope. This code has been adopted by state and local jurisdictions across the country.

## Infrastructure

### Water

An estimated average of 44 mgy of potable water would be required for CFV using maximum water conservation measures. The transit center, using normal water conservation measures, would use an additional 2 mgy, supplied from the Roaring Springs system in GCNP. Additional potable water for CFV would be supplied through water harvesting, water recycling, and water retreatment.

Water conservation measures to be implemented under this alternative include dual-plumbing of lodging and multi-family residences for use in toilets, treatment of reclaimed water for potable use at CFV, water harvesting from parking areas and roof tops, landscape irrigation with reclaimed wastewater, xeriscaping, maximum water conservation fixtures (toilet, faucet, and showerhead), and no bathtubs in dormitories and in a minimum of 25% of the lodging units.

A contract with the federal government would provide fifth priority water from the Colorado River, and two contracts with Central Arizona Water Conservation District (CAWCD) would allow CFV to obtain sufficient water credits to be exchanged for the right to divert water from the Colorado River during times when fifth priority water is not available. Figure 2.10 outlines the CFV water delivery concept.

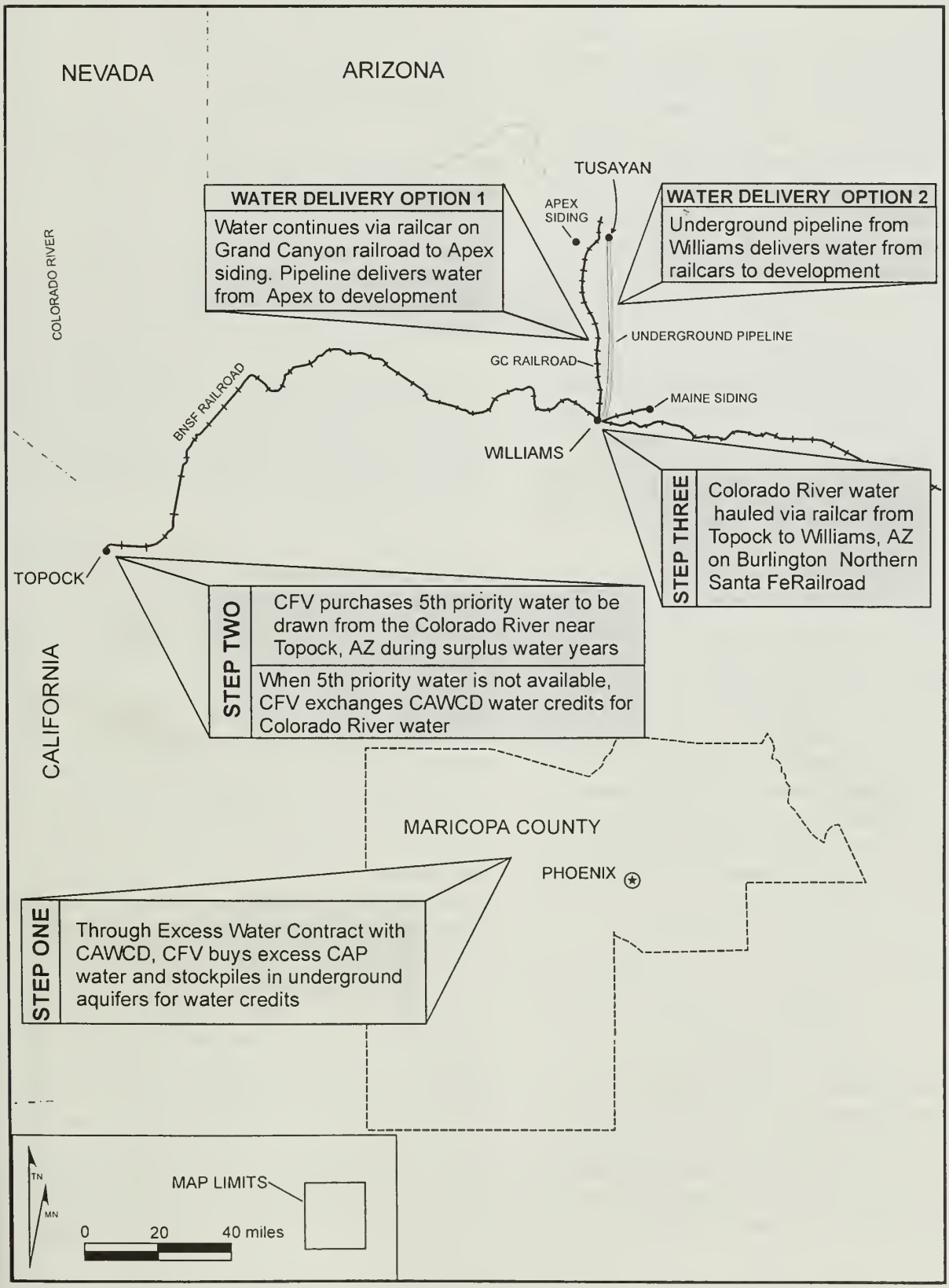
Colorado River water would be the primary source of potable water for CFV. A contract with the U.S. government would provide up to 400 acre-feet per year of fifth priority water from the Colorado River during times when the Bureau of Reclamation declares fifth priority water to be available. Fifth priority water is only available during times of surplus. During times of water shortage in the Colorado River system, this source would be curtailed, if not eliminated and Central Arizona Project (CAP) water would be used.

Fifth-priority Colorado River water would be pumped from well(s) near Topock, Arizona and would to be hauled via rail car along the Burlington Northern/Santa Fe Railroad (BNSF) to Maine Siding, eight miles east of Williams, Arizona. Two options are being explored to deliver the water from Maine Siding. Under option one, water would continue via railcar to Apex Siding, just south of Tusayan. A pipeline would be constructed from Apex Siding to the CFV development for water delivery. Under option two, water would be transported via pipeline from the Maine Siding to CFV. Existing rights-of-ways and transportation corridors would be used in traversing the 60 miles with an underground pipe, 6-inches to 8-inches in diameter.

Fifth priority water is not a reliable source; therefore, a long-term water supply is needed. CFV has contracted with CAWCD for excess CAP Municipal & Industrial water under an excess water contract. Through this contract, CFV could order up to 10,000 acre-feet (approximately 3,300 mgy) of excess water per year from CAWCD to accumulate 40,000 acre-feet over 10 years. Under an additional contract with a licensed underground storage facility, this water would be used to recharge groundwater aquifers in central Arizona. CFV would thus earn credits to be redeemed on a one-to-one basis for Colorado River water to be drawn near Topock during times when fifth priority water is not available.

The initial term of this excess water contract with CAWCD is ten years. This contract may provide a reserve against any shortfalls in the fifth-priority water supply contract, and allow enough excess water to be banked to secure enough water for this project, for a minimum of 100 years.

Figure 2.10 Water Delivery Concept in Alternative H


NEVADA
ARIZONA
TUSAYAN
APEX SIDING
WATER DELIVERY OPTION 1
Water continues via railcar on Grand Canyon railroad to Apex siding. Pipeline delivers water from Apex to development
WATER DELIVERY OPTION 2
Underground pipeline from Williams delivers water from railcars to development
COLORADO RIVER
UNDERGROUND PIPELINE
GC RAILROAD
BNSF RAILROAD
MAINE SIDING
WILLIAMS
STEP THREE
Colorado River water hauled via railcar from Topock to Williams, AZ on Burlington Northern Santa FeRailroad
TOPOCK
STEP TWO
CFV purchases 5th priority water to be drawn from the Colorado River near Topock, AZ during surplus water years
When 5th priority water is not available, CFV exchanges CAWCD water credits for Colorado River water
CALIFORNIA
MARICOPA COUNTY
PHOENIX
STEP ONE
Through Excess Water Contract with CAWCD, CFV buys excess CAP water and stockpiles in underground aquifers for water credits
TN
MN
MAP LIMITS
0
20
40 miles

### Energy
Under this alternative, most energy needs would be met using traditional systems. Energy conservation would be achieved by manufactured applications, building envelops, natural heating and cooling systems, and energy-efficient equipment and appliances. Conventional electricity would be the main energy source, supplied by APS. Natural gas or liquefied natural gas (LNG) may also be used. Active and passive solar applications would contribute not less than 10% of the total energy supply. The overall energy requirements are reduced through the use of energy conserving building materials, designs, and techniques.

### Solid Waste Management
Solid waste would be hauled to the City of Flagstaff landfill by a private contractor, unless a regional solid waste facility is established closer to Tusayan in the future. Solid waste would be reduced through curbside collection and marketing of basic recyclable materials, potentially with separating facilities at lodging, apartments, and dorms.

### Wastewater Management
Under Alternative H, a solar aquatic wastewater treatment system would be used rather than a conventional treatment system. This type of natural, biological system uses less energy and no chemicals in the treatment process. This system consists of greenhouses with solar ponds and vegetation beds that treat effluent for subsequent discharge to composting reed beds and infiltration basins. Reclaimed water from the solar-aquatics wastewater system may be 1) discharged to natural or man-made ponds, 2) used for irrigation of local landscape, 3) used for toilet flushing in dual-plumbed facilities, or 4) retreated in a mechanical (reverse osmosis) treatment facility for re-use as a potable source.

Unlike osmosis (movement across a semipermeable membrane from low ionic solutions to high ionic solutions), reverse osmosis is a mechanical process in which pure water becomes deionized as it is forced to flow through membranes, leaving a highly concentrated ionic solution in an enclosed membrane. Given its ionic properties, water will naturally flow from a low concentration solution to a high concentration solution. The movement of water from a high concentration solution to a low concentration solution, needed to purify water for re-use as a potable source, therefore requires a mechanical force.

### Project Implementation
Development and operation of the transit center would be under the terms and conditions of the special use permit as well as agreements with the Forest Service and NPS.

Development densities and phasing proposed under this alternative would be enforced though agreements with Coconino County. A comprehensive development agreement between CFV and Coconino County would be used to ensure achievement of development densities and phasing. Coconino County would be responsible for enforcement of the development agreement and associated conditions of County approval, as it is for other developments in Coconino County.

Two organizations would play essential roles in implementing the plan for the CFV development: the Kaibab Institute (Institute) and the Environmental Preservation Trust Entity (EPTE). Each entity would derive its operating funds from separate sources.

**Kaibab Institute**
The Institute, a non-profit corporation, would be the entity responsible for community governance in the development. The Institute would carry out its activities through a board of directors, potentially composed of residential and commercial property owners within the development; environmental organizations; and through committees composed of property owners, residents, and others. Local and federal agency representatives would serve in an advisory capacity to the board of directors.

The Institute would administer and enforce the CC&Rs that apply to the property and govern such issues as architectural control, use restrictions, and maintenance of any open space or other "common area." The CC&Rs would run with title to all property in the development. The CC&Rs would establish a general plan of development, a procedure to ensure that all new construction and modifications to existing structures

and completed lots are consistent with the plan of development, a minimum maintenance standard for all property within the development, and assessment obligations and procedures. The CC&Rs would also provide that the Institute would own and maintain the common property in the development and would have the authority to enforce the provisions of the CC&Rs.

To ensure uniform architectural standards, CFV would prepare design guidelines based on the GCNP architectural character guidelines, describing the general architectural standards for the community. The design guidelines may vary for different lots according to proposed use, location, and special conditions. They would include specific requirements regarding areas of particular concern, such as setbacks, building height, impact on the natural environment, driveways, and garages. The design guidelines may also list suggested materials for construction and landscaping. In addition, the design guidelines may set standards for the construction process, such as when construction must begin and be completed and appearance of the construction site.

Initially, CFV would have the authority to review and approve all applications for new construction and landscaping or modifications to existing structures or landscaping to ensure that the development plans are firmly established. As development progresses, CFV would transfer its responsibility for reviewing applications for construction or modifications to an architectural review committee appointed by the Institute.

The CC&Rs would also establish a framework for the creation of standards governing an owner's, lessee's, or resident's use and maintenance of, as well as conduct upon, any lot located within the development. The provisions would be structured to allow for some initial determinations regarding permitted uses of lots and accompanying standards and to allow the Institute to modify these use restrictions and rules as the needs of the community unfold. The CC&Rs may also include a list of specific rights of owners, lessees, and residents that cannot be altered to protect essential rights of owners, lessees, and residents. In addition, the CC&Rs would include restraints upon the leasing and ownership of property.

All residences in the development, including those residences constructed on CFV-owned land leased to others, must be occupied by at least one person who is a "resident" or "qualified renter." A resident is a person who continually lives in the development and who is employed in GCNP, in the CFV development, or within the Tusayan Ranger District of KNF, including unincorporated areas of Tusayan and other privately owned areas within the district. A qualified renter is an individual who is employed at CFV, GCNP, or within the Tusayan Ranger District, for as long as they remain in such employment. The CC&Rs would empower the Institute to grant exceptions to residents and renters in hardship situations.

In the event that a property owner, lessee, or resident violates the use restrictions and rules, the Institute would have the authority to enforce various sanctions, which may include levying fines, suspension of rights, suspension of services provided by the Institute, and, if necessary, correcting the violation and charging the property owner for any costs.

In addition to providing housing to people who live and work in the area, a second objective of the development is ensuring that the housing is affordable. CFV would provide initial guidelines on the profile characteristics of eligible households. Employees of the service industry and entry-level federal employees are among the targeted categories of home buyers. Income level would likely play an important role in determining program eligibility. A certain percentage of homes throughout the development would be governed with the program restrictions. CFV would provide initial design and price-level guidelines to ensure quality construction and affordability.

Responsibility and oversight of the housing program would be the assigned to the Institute. The housing program restrictions run with title to the property and apply to all future property owners.

To ensure that housing stays affordable, the future appreciation of homes would be limited through language contained in the CC&Rs. The governing documents would require that appreciation on homes subject to the restrictions be linked to some index figure such as the Consumer Price Index.

Under the recapture program, specific homes within the development would be identified as "recapture homes." Recapture homes would be kept affordable by limiting eligible purchasers to a specific group of qualified individuals and by requiring owners of the recapture homes, upon resale, to submit a portion of the appreciation that has accumulated on the home to a private non-profit administrative entity, such as the Institute. The recapture fees would become part of the operating budget of the Institute. Recapture fees would be used by the Institute to subsidize the price of recapture homes to maintain their affordability.

The Institute would also have the responsibility for maintaining the community's common areas. Responsibilities may include maintenance of common property in the development, upkeep of storm water retention and drainage systems, maintenance of pedestrian and bike pathways, and, to a limited extent, landscaping and lighting.

Funding for the Institute's governance expenses would be raised primarily through annual base assessments charged to all commercial property owners. The amount of each year's assessment would be determined by the Institute by dividing its budget expenses among all property owners pursuant to a formula. Residential property lessees may pay the same annual base assessment. Commercial property may have a variable base assessment rate tied to square footage, gross revenue, or some other verifiable standard. Property owners would not be able to exempt themselves from the obligation to pay assessments by nonuse of the common property.

The Institute also may collect neighborhood assessments, special assessments, and specific assessments. Neighborhood assessments are charged to all property owners, lessees and residents in a distinct "neighborhood" to pay for a special service provided by the Institute, such as exterior maintenance, or maintenance of special facilities, such as covered parking, that is not offered or available to other property owners, lessees, and residents in the development. In addition, property owners, lessees, and residents in a neighborhood may request that the Institute provide a special service and charge the cost as a neighborhood assessment.

The Institute may, with input from the property owners and lessees, levy special assessments to cover unbudgeted expenses such as capital improvements. The Institute may also levy special assessments against individual property owners and lessees who do not comply with the restrictions to pay for the cost of correcting nonconforming conditions (e.g., removing accumulated trash) or who request a special service offered by the Institute (e.g., exterior maintenance).

In addition to assessments, other funding sources for the Institute may include user fees, special event fees, transfer fees, and recapture fees. User fees would be charged if a resident or non-resident of the community wants to use specific services or facilities. Special event fees would be charged to the sponsor of a special event for the use of facilities, services, or areas within the development during the event. The closing of a sale or transfer of any property within the CFV development may result in payment of a transfer fee by the seller to the Institute.

**Environmental Preservation Organization**

A consortium of environmental organizations would establish an EPTE, funded by CFV, to ensure that environmental commitments are enforced and would establish a permanent revenue source, at 1.0% of gross revenues to carry out its environmental functions. Based on revenue projections for Alternative H, annual funding for the EPTE would range from $1.3 million in year one to $1.8 million in year 10. The mission of the EPTE is to realize the long-term conservation and community priorities in the area, including the enforcement of mitigation measures outlined in the EIS. CFV would cooperate with the Forest Service, NPS, and Coconino County to establish the EPTE as a tax-exempt organization funded by CFV and other sources.

The primary responsibility of the EPTE would be to preserve and enhance the natural environmental setting within and surrounding the development through a wide range of programs and partnerships, including public education, acquisition of land or conservation easements, ecological restoration and various other activities. The EPTE could have the following responsibilities:

- support or carry out long-term ecological and archeological monitoring and research to evaluate the long-term impact of development in the region and the effectiveness of mitigation measures
- carry out long-term cross-boundary ecological restoration and conservation projects around KNF and GCNP (e.g., wildlife management measures, particularly those related to development impacts)
- provide start-up funding and ongoing support for programs to acquire land or conservation easements in the region for ecological and scenic purposes with the CFV Council, prepare environmental guidelines for incorporation into the CC&Rs to address architectural standards, construction materials, landscaping, water and energy conservation, and other sustainable design technologies
- promote long-term implementation and maintenance of commitments to water conservation, native plant landscaping, energy efficiency and conservation, sustainable architecture, soil erosion, air quality, excessive lighting, noise, exotic animal problems, wildlife conservation, recycling, and other sustainability features
- carry out activities to incorporate over time new sustainable design technologies as these technologies become cost-effective (e.g., work with builders, homeowners, and businesses to develop and carry out community-wide water conservation, energy efficiency, waste reduction, recycling and waste recovery programs)
- manage and maintain a system of multi-purpose trails within and around the gateway development to link the development with GCNP and other community facilities
- in coordination with INSIGHT, have primary responsibility for environmental education targeted to visitors, school children, and residents and property owners in the development

The EPTE would carry out these activities within and surrounding the CFV development and offsite when necessary to address the regional impacts of the development.

### Project Cost

This alternative would be funded through private investments. Construction cost for this alternative is estimated to be $17 million for the transit center and $308 million for the visitor retail/residential segment.

### Implementation Schedule

The implementation of this alternative revolves around the need to build visitor services and facilities that generate income so other aspects of the alternative that require subsidy (infrastructure and community facilities) can be built. The transit center would be constructed independently of CFV within the first year. In the visitor segment, the majority of lodging (900 units) and all the retail facilities (270,000 square feet) would be constructed in the first year. The remaining lodging (370 units) would be constructed in the second year. Like the visitor segment, housing components of the community segment would be phased to keep pace with housing demands from an increased employment base. Improved land would be made available for lease to the NPS for NPS and/or concessionaire housing in the first year of operation. The proposed community center, police/fire station, and residential park would be constructed in the first year of operation. Lots for the house(s) of worship, post office, library, and medical facility would be made available for sale or lease in the first year. A school site with infrastructure would be developed and donated to the school district in the first year.

## Sustainable Design Elements

Sustainable design elements are an integral part of some of the alternatives, particularly Alternatives B and H. Table 2.8 compares the design elements of all the alternatives (Alternative A through H). The list of design elements was determined based on the Ahwanhee Principles and the LEED™ rating system.

The U.S. Green Building Council (USGBC) is a non-profit, consensus coalition promoting and understanding development, and accelerated implementation of green building policies, programs, technologies, standards, and design practices. The USGBC has developed a rating system for sustainable development called the Leadership in Energy and

Environmental Design (LEED™) Green Building Rating System. LEED™ is a voluntary rating system that evaluates the environmental performance of buildings. LEED™ encourages the use of sustainable design features that incorporate existing proven technology, accepted energy and environmental principles, and emerging concepts. The intent of the LEED™ rating system is to establish a standard for green buildings. Although not formally recognized or endorsed by LEED™, aspects of the rating system can also be applied on a broader perspective to mixed-use developments.

Under the LEED™ system, the extent of design elements are rated by assigning credits for satisfying criteria within various building elements. To receive classification as a LEED™ building, applicants must first meet a series of prerequisites related to asbestos, building commissioning, energy efficiency, indoor air quality, ozone depletion, smoking ban, storage and collection of recyclables, thermal comfort, water conservation, and water quality. After satisfying all prerequisites, applicant buildings are rated according to its degree of compliance with the credit system.

A total of 44 credits, plus four bonus credits, are available under the LEED™ rating system, with four categories of certification:

- Platinum - buildings that earn 81 percent (36) or more of available credits
- Gold - buildings that earn 71 to 80 percent (31-35) of available credits
- Silver - buildings that earn 61 to 70 percent (27-30) of available credits
- Bronze - buildings that earn 50 to 60 percent (22-26) of available credits

Building elements and available credits under each element are listed below:

- Building materials: use of local materials and low VOC materials; paints, coatings, sealants, and adhesives must meet USGBC standards or performance; and recycled content of building materials
- Construction waste management: recycle or reuse construction materials or reintroduction of construction materials into the market place.
- Energy: use of building envelopes; use of natural ventilation, heating and cooling; application of renewable/alternative energy sources.
- Indoor air quality: Development and adherence to air quality monitoring and management plans
- Landscaping/exterior design: Protection of native vegetation; use of tree planting and erosion control
- LEED™-certified designer: A LEED™ architect
- Occupant recycling: installation of recycling equipment and facilities
- Operations and maintenance facilities: chemical storage and mixing areas; entryways to minimize indoor air quality degradation
- Ozone depletion/CFCs: elimination of CFC, HCFC, and halon use
- Siting: preservation and restoration of building/ construction sites; use of pervious materials for parking lots and trails; restoration of 50% of degraded habitat areas on the site; and provision of open space.
- Transportation: installation of foot and bike path systems; use of alternative-fueled vehicles and re-fueling facilities.
- Water conservation: installation of water conserving fixtures, water conserving cooling towers, water efficient landscaping, and water recovery systems, water harvesting and nonpotable water reuse.
- Water quality: surface runoff filtration and reduction, biological waste treatment system.

**Table 2.8 Comparison of Design Elements**

| Design Element | | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F | Alternative G | Alternative H |
|---|---|---|---|---|---|---|---|---|---|
| **1. Community Integration** | **1. A variety of uses are provided for within the proposed development** | Current uses within Tusayan are largely commercial and residential. The mix of uses in future development would be at the discretion of the landowner or the Coconino County Board of Supervisors | A mixed-use gateway community with commercial, residential, and community facilities would be developed | A mixed-use gateway community with commercial, residential, and community facilities would be developed | A mixed-use gateway community with commercial, residential, and community facilities would be developed | Current uses within Tusayan are largely commercial and residential. The mix of uses in future development would be at the discretion of the landowner or the Coconino County Board of Supervisors | A mixed-use gateway community with commercial, residential, and community facilities would be developed | A mixed-use gateway community with commercial, residential, and community facilities would be developed | A mixed-use gateway community with commercial, residential, and community facilities would be developed |
| | **2. The proposed development is integrated with the existing community of Tusayan** | No specific development plans are proposed. Integration of future development with the existing community would be at the discretion of the land owner or the Coconino County Board of Supervisors | Proposed community facilities and community retail would be within walking distance (½ mile) of Tusayan. The proposed residential area is immediately adjacent to the existing residential area of Tusayan. There is not a clearly defined connection between the transit center in CFV and the existing commercial properties in Tusayan | Proposed community facilities and community retail would be within walking distance (½ mile) of Tusayan. The proposed residential area is immediately adjacent to the existing residential area of Tusayan. There is not a clearly defined connection between the transit center in CFV and the existing commercial properties in Tusayan | Certain proposed community facilities would not be within walking distance (>½ mile) of the existing residential area of Tusayan. The proposed residential area is not immediately adjacent to the existing residential area of Tusayan. There is a clearly defined connection between the transit center and the existing commercial properties in Tusayan | The proposed residential area is immediately adjacent to the existing residential area of Tusayan. There is a clearly defined connection between the transit center and the existing commercial properties in Tusayan | Proposed community facilities would be within walking distance (½ mile) of Tusayan. The proposed residential area is immediately adjacent to the existing residential area of Tusayan. There is a clearly defined connection between the transit center and the existing commercial properties in Tusayan. | Proposed community facilities and community retail would be within walking distance (½ mile) of Tusayan. The proposed residential area is immediately adjacent to the existing residential area of Tusayan. There is a clearly defined connection between the transit center in CFV and the existing commercial properties in Tusayan | Proposed community facilities and community retail would be within walking distance (½ mile) of Tusayan. The proposed residential area is immediately adjacent to the existing residential area of Tusayan. There is a clearly defined connection between the transit center in CFV and the existing commercial properties in Tusayan |
| | **3. The proposed development provides integration of community uses on a regional basis** | Potential development of private inholdings could result in satellite communities and duplication of services | Federal acquisition of private inholdings would reduce potential for scattered development. Development would be concentrated in the Tusayan area | Federal acquisition of private inholdings would reduce potential for scattered development. Development would be concentrated in the Tusayan area | Potential development of private inholdings could result in satellite communities and duplication of services | Potential development of private inholdings could result in satellite communities and duplication of services | Potential development of private inholdings could result in satellite communities and duplication of services | Federal acquisition of private inholdings would reduce potential for scattered development. Development would be concentrated in the Tusayan area | Federal acquisition of private inholdings would reduce potential for scattered development. Development would be concentrated in the Tusayan area |

| Design Element | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F | Alternative G | Alternative H |
|---|---|---|---|---|---|---|---|---|
| **2. Building Materials and Construction Waste Management** | Traditional building techniques, economics, and county regulations would dictate the type of construction materials and the amount of waste generated | 20% of building materials manufactured within 300 miles of site<br><br>Low volatile organic compound (VOC) materials used<br><br>20% of site materials using 20% post-consumer recycled content **or** 40% post-industrial recycled content<br><br>Construction waste is recycled by licensed haulers of recyclables<br><br>Recycling of cardboard, metals, concrete, brick, asphalt, land clearing debris and beverage containers | Traditional building techniques, economics, and county regulations would dictate the type of construction materials and the amount of waste generated | Traditional building techniques, economics, and county regulations would dictate the type of construction materials and the amount of waste generated | Traditional building techniques, economics, and county regulations would dictate the type of construction materials and the amount of waste generated | Traditional building techniques, economics, and county regulations would dictate the type of construction materials and the amount of waste generated | Traditional building techniques, economics, and county regulations would dictate the type of construction materials and the amount of waste generated | 20% of building materials manufactured within 300 miles of site<br><br>Low volatile organic compound (VOC) materials used<br><br>20% of site materials using 20% post-consumer recycled content **or** 40% post-industrial recycled content<br><br>Construction waste is recycled by licensed haulers of recyclables<br><br>Recycling of cardboard, metals, concrete, brick, asphalt, land clearing debris and beverage containers |
| **3. Energy Supply** | Primary energy source: Electricity<br><br>Secondary energy source: on-site power generation may be available for some private inholdings | Primary energy source: Fuel cells and natural gas<br><br>Natural gas or Liquefied Natural Gas may be transported to CFV<br><br>Active and passive solar systems would reduce energy needs | Primary energy source: Electricity<br><br>Natural gas or Liquefied Natural Gas may be transported to CFV<br><br>Active and passive solar systems would reduce energy needs | Primary energy source: Electricity<br><br>Secondary energy source: on-site power generation may be available for some private inholdings | Primary energy source: Electricity<br><br>Secondary energy source: on-site power generation may be available for some private inholdings | Primary energy source: Electricity<br><br>Secondary energy source: on-site power generation may be available for some private inholdings | Primary energy source: Electricity<br><br>Natural gas or Liquefied Natural Gas may be transported to CFV<br><br>Active and passive solar systems would reduce energy needs | Primary energy source: Electricity<br><br>Natural gas or Liquefied Natural Gas may be transported to CFV<br><br>Active and passive solar systems supply not less than 10% of energy needs. |

| Design Element | | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F | Alternative G | Alternative H |
|---|---|---|---|---|---|---|---|---|---|
| **4. Indoor Air Quality** | | Conventional systems | Prepare and implement an indoor air quality plan that addresses protection of the ventilation system components (intakes and exhaust) from contamination<br><br>Reduction of construction contaminants in the building prior to occupancy (dust, water infiltration-related contamination, VOCs)<br><br>Permanent indoor air quality monitoring system in lodging and INSIGHT | Conventional systems | Conventional systems | Conventional systems | Conventional systems | Conventional systems | Prepare and implement an indoor air quality plan that addresses protection of the ventilation system components (intakes and exhaust) from contamination<br><br>Reduction of construction contaminants in the building prior to occupancy (dust, water infiltration-related contamination, VOCs)<br><br>Permanent indoor air quality monitoring system in lodging and INSIGHT |
| **5.Landscaping and Exterior Design** | **1. Building Design** | Building design would be at the discretion of the land owner or as required by the Coconino County Board of Supervisors<br><br>No common architectural theme is required for development | Building design would follow GCNP architectural design guidelines<br><br>A common architectural theme would be adopted | Building design would follow GCNP architectural design guidelines<br><br>A common architectural theme would be adopted | Building design would be at the discretion of the land owner or as required by the Coconino County Board of Supervisors<br><br>No common architectural theme is required for development | Building design would follow GCNP architectural design guidelines<br><br>A common architectural theme would be adopted | Building design would follow GCNP architectural design guidelines<br><br>A common architectural theme would be adopted | Building design would follow GCNP architectural design guidelines<br><br>A common architectural theme would be adopted | Building design would follow GCNP architectural design guidelines<br><br>A common architectural theme would be adopted |
| | **2. Landscaping Guidelines** | Landscaping guidelines would follow the Tusayan Area Plan, which require that 10 - 20% of developed area would be landscaped with indigenous or low water consuming plants | Landscaping guidelines would follow the Tusayan Area Plan, which require that 10 - 20% of developed area would be landscaped with indigenous or low water consuming plants | Landscaping guidelines would follow the Tusayan Area Plan, which require that 10 - 20% of developed area would be landscaped with indigenous or low water consuming plants | Landscaping guidelines would follow the Tusayan Area Plan, which require that 10 - 20% of developed area would be landscaped with indigenous or low water consuming plants | Landscaping guidelines would follow the Tusayan Area Plan, which require that 10 - 20% of developed area would be landscaped with indigenous or low water consuming plants | Landscaping guidelines would follow the Tusayan Area Plan, which require that 10 - 20% of developed area would be landscaped with indigenous or low water consuming plants | Landscaping guidelines would follow the Tusayan Area Plan, which require that 10 - 20% of developed area would be landscaped with indigenous or low water consuming plants | Landscaping guidelines would follow the Tusayan Area Plan, which require that 10 - 20% of developed area would be landscaped with indigenous or low water consuming plants<br><br>One tree would be planted for every 1,000 sq ft of parking or building space |
| | **3. Dedicated Open Space** | No special requirements imposed by Coconino County | Open space would include 112 acres or 17% of the 672 acre development | Open space would include 10 acres or 3% of the 380 acre development | Open space would include 10-15 acres or between 8 5% to 13% of the 117 acre development | Open space would include 25 acres or 21% of the 120 acre development | None | Open space would include 71 acres or 26% of the 270 acre development | Open space would include 70 acres or 26% of the 271 acre development |
| **6. Recycling Program** | | A recycling program for Tusayan has been proposed, but has not been implemented | Aluminum, paper, glass, and some plastic material would be recycled, with curb-side pick-up | Aluminum, paper, glass, and some plastic material would be recycled | A recycling program for Tusayan has been proposed, but has not been implemented | Aluminum, paper, glass, and some plastic material would be recycled at the federal housing complex and transit center | Aluminum, paper, glass, and some plastic material would be recycled at the federal housing complex and transit center | Aluminum, paper, glass, and some plastic material would be recycled, with curb-side pick-up | Aluminum, paper, glass, and some plastic material would be recycled, with curb-side pick-up |

| Design Element | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F | Alternative G | Alternative H |
|---|---|---|---|---|---|---|---|---|
| **7. Operations and Maintenance Facilities** | No special requirements beyond county health regulations | Chemical storage and mixing areas for commercial/industrial facilities<br>-adequate and secure product storage<br>-drains plumbed for appropriate disposal of liquid waste<br>-vented to outside<br>-facility operates under negative pressure<br><br>Architectural entryways with grills, grates, doors and double entries to reduce contamination of indoor air | No special requirements beyond county health regulations | No special requirements beyond county health regulations | No special requirements beyond county health regulations | No special requirements beyond county health regulations | No special requirements beyond county health regulations | Chemical storage and mixing areas for commercial/industrial facilities.<br>-adequate and secure product storage<br>-drains plumbed for appropriate disposal of liquid waste<br>-vented to outside<br>-facility operates under negative pressure<br><br>Architectural entryways with grills, grates, doors and double entries to reduce contamination of indoor air |
| **8. Ozone Depletion and Use of CFCs** | No special requirements beyond federal law(s) | No use of CFC, HCFC, and Halon in mechanical equipment and building materials | No special requirements beyond federal law(s) | No special requirements beyond federal law(s) | No special requirements beyond federal law(s) | No special requirements beyond federal law(s) | No special requirements beyond federal law(s) | Eliminate CFC, HCFC, and Halon in 75% of mechanical equipment and building materials |
| **9. Siting** | Preservation of native vegetation subject to the landowners discretion and Coconino County Board of Supervisors approval<br><br>Tusayan Area Plan encourages preservation of native vegetation, and requires revegetation of steep slopes | Preservation of topsoil, removed and set aside<br><br>Preservation of native vegetation is considered in the design and location of buildings and roadways<br><br>Limit construction disturbance around buildings to a 50 foot perimeter<br><br>Relocate trees 8 feet tall or smaller in disturbed areas<br><br>Open space management plan prepared and adopted to address care and maintenance of open areas and buffer zones | Preservation of native vegetation subject to the landowners discretion and Coconino County Board of Supervisors approval<br><br>Tusayan Area Plan encourages preservation of native vegetation, and requires revegetation of steep slopes<br><br>Open space management plan prepared and adopted to address care and maintenance of open areas and buffer zones | Preservation of native vegetation subject to the landowners discretion and Coconino County Board of Supervisors approval<br><br>Tusayan Area Plan encourages preservation of native vegetation, and requires revegetation of steep slopes | Preservation of native vegetation subject to the landowners discretion and Coconino County Board of Supervisors approval<br><br>Tusayan Area Plan encourages preservation of native vegetation, and requires revegetation of steep slopes | Preservation of native vegetation subject to the landowners discretion and Coconino County Board of Supervisors approval<br><br>Tusayan Area Plan encourages preservation of native vegetation, and requires revegetation of steep slopes | Preservation of native vegetation is considered in the design and location of buildings and roadways<br><br>Limit construction disturbance around buildings to a 50 foot perimeter<br><br>Open space management plan prepared and adopted to address care and maintenance of open areas and buffer zones | Preservation of topsoil, removed and set aside<br><br>Preservation of native vegetation is considered in the design and location of buildings and roadways<br><br>Limit construction disturbance around buildings to a 50 foot perimeter<br><br>Relocate trees 8 feet tall or smaller in disturbed areas<br><br>Open space management plan prepared and adopted to address care and maintenance of open areas and buffer zones |

| Design Element | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F | Alternative G | Alternative H |
|---|---|---|---|---|---|---|---|---|
| **10. Transportation** | The Grand Canyon Railway Spurline may be built from Grand Canyon Airport to GCNP to accommodate up to 1,000,000 visitors per year | Mass transit would be provided for visitors to GCNP<br><br>Pedestrian walkways would link transit center with village core and Tusayan<br><br>Two internal shuttle systems would be available within CFV for visitors and residents. A shuttle system would also link CFV with Tusayan and the transit center | Mass transit would be provided for visitors to GCNP<br><br>Pedestrian walkways would link transit center with village core and Tusayan<br><br>Two internal shuttle systems would be available within CFV for visitors and residents. A shuttle system would also link CFV with Tusayan and the transit center | Mass transit would be provided for visitors to GCNP<br><br>A pedestrian bridge over Highway 64 would link visitors from the transit center to other commercial uses in Tusayan. At-grade crossings would also be available along Highway 64<br><br>Employee shuttle system would be provided along Long Jim Canyon to Tusayan businesses | Mass transit would be provided for visitors to GCNP<br><br>Pedestrian walkways would link transit center with Tusayan<br><br>Shuttle not provided for employees living in the federal housing complex | Mass transit would be provided for visitors to GCNP<br><br>Pedestrian walkways would link transit center with Tusayan<br><br>Shuttle not provided for employees living in the federal housing complex | Mass transit would be provided for visitors to GCNP<br><br>Pedestrian walkways would link transit center with village core and Tusayan<br><br>Shuttle not provided for employees living in the federal housing complex | Mass transit would be provided for visitors to GCNP<br><br>Pedestrian walkways would link transit center with village core and Tusayan<br><br>Shuttle not provided for employees living in the federal housing complex |
| **11. Water Conservation Measures** | Tusayan Area Plan requires water conservation measures including use of nonpotable water for toilet flushing and irrigation, use of low water fixtures, and xenscaping<br><br>Areas outside Tusayan would comply with Coconino County Comprehensive Plan | Maximum water conservation measures would be implemented, including xeriscaping, irrigation with reclaimed water, rainfall harvesting, minimum water use fixtures in all structures, and no tubs in dormitories and a minimum of 25% of the lodging units | Tusayan Area Plan requires water conservation measures including use of nonpotable water for toilet flushing and irrigation, use of low water fixtures, and xeriscaping<br><br>Areas outside Tusayan would comply with Coconino County Comprehensive Plan | Tusayan Area Plan requires water conservation measures including use of nonpotable water for toilet flushing and irrigation, use of low water fixtures, and xeriscaping<br><br>Areas outside Tusayan would comply with Coconino County Comprehensive Plan | Tusayan Area Plan requires water conservation measures including use of nonpotable water for toilet flushing and irrigation, use of low water fixtures, and xeriscaping<br><br>Areas outside Tusayan would comply with Coconino County Comprehensive Plan | Tusayan Area Plan requires water conservation measures including use of nonpotable water for toilet flushing and irrigation, use of low water fixtures, and xeriscaping<br><br>Areas outside Tusayan would comply with Coconino County Comprehensive Plan | Tusayan Area Plan requires water conservation measures including use of nonpotable water for toilet flushing and irrigation, use of low water fixtures, and xeriscaping<br><br>Areas outside Tusayan would comply with Coconino County Comprehensive Plan | Maximum water conservation measures would be implemented, including xeriscaping, irrigation with reclaimed water, rainfall harvesting, minimum water use fixtures in all structures, and no tubs in dormitories and a minimum of 25% of the lodging units |
| **12. Wastewater Treatment** | Conventional wastewater treatment facilities would be constructed or development would tie into existing conventional systems | A solar aquatic waste system would be developed to handle wastewater from CFV and the transportation staging area | Conventional wastewater treatment facilities would be constructed or development would tie into existing conventional systems | Conventional wastewater treatment facilities would be constructed or development would tie into existing conventional systems | Conventional wastewater treatment facilities would be constructed or development would tie into existing conventional systems | Conventional wastewater treatment facilities would be constructed or development would tie into existing conventional systems | Conventional wastewater treatment facilities would be constructed or development would tie into existing conventional systems | A solar aquatic waste system would be developed to handle wastewater from CFV and the transportation staging area |
| **13. Use Products Made From Recycled Materials** | No special requirements imposed | 20% of building materials manufactured within 500 miles of site<br><br>Materials contain low volatile organic compounds (VOCs)<br><br>20% of site materials using 20% post-consumer recycled content or 40% post-industrial recycled content | Recycled materials would be used where economically feasible | No special requirements imposed | None proposed | None proposed | Recycled materials would be used where economically feasible | 20% of building materials manufactured within 500 miles of site<br><br>Materials contain low volatile organic compounds (VOCs)<br><br>20% of site materials using 20% post-consumer recycled content or 40% post-industrial recycled content |

| Design Element | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F | Alternative G | Alternative H |
|---|---|---|---|---|---|---|---|---|
| **14. Environmental Preservation Organization** | None created | An Environmental Preservation Trust Entity would be created with funding from commercial development. Contributions would be calculated based on 1% of gross sales | An Environmental Preservation Trust Entity would be created with funding from commercial development Contributions would be calculated based on 1% of gross sales | None created | None created | None created | Kaibab Institute would be created with funding from commercial development. Contributions would be calculated based on 0 1% of gross sales | An Environmental Preservation Trust Entity would be created with funding from commercial development. Contributions would be calculated based on 1% of gross sales |
| **15. Night Lighting** | Zone III (county ordinance) specified in the County Comprehensive Plan<br><br>Night lighting accomplished by using conventional street lights | Zone II (county ordinance) specified in the County Comprehensive Plan<br><br>Night lighting accomplished by using sky-shields, and low-level fixtures | Zone III (county ordinance) specified in the County Comprehensive Plan<br><br>Night lighting accomplished by using conventional street lights | Zone III (county ordinance) specified in the County Comprehensive Plan<br><br>Night lighting accomplished by using conventional street lights | Zone III (county ordinance) specified in the County Comprehensive Plan<br><br>Night lighting accomplished by using conventional street lights | Zone III (county ordinance) specified in the County Comprehensive Plan<br><br>Night lighting accomplished by using conventional street lights | Zone III (county ordinance) specified in the County Comprehensive Plan<br><br>Night lighting accomplished by using conventional street lights | Zone II (county ordinance) specified in the County Comprehensive Plan.<br><br>Night lighting accomplished by using sky-shields, and low-level fixtures |
| **LEEDS CLASSIFICATION** | Not able to meet bronze | Bronze | Not able to meet bronze | Not able to meet bronze | Not able to meet bronze | Not able to meet bronze | Not able to meet bronze | Silver |

## Land Values and Fees

Concurrent with the EIS process, there is an ongoing appraisal of the federal and private lands involved in the alternatives by an independent professional appraiser. This land value information has application to all of the action alternatives. For the alternatives involving a land exchange, the value of federal and private land must be equal. Differences in dollar value between the federal and private land can be balanced with acreage adjustments or addressed with a cash equalization payment by the agency or proponent for up to 25% of the value of the federal land. For the alternatives involving Townsite Act, the appraisal will determine the fair market value of the federal land specified for acquisition under the Townsite Act. For the alternatives involving a special use permit, the appraisal information for the federal land will serve as the basis for the fee structure for the facilities under special use permit. Initial land value information for each action alternative is provided below.

Alternative B: (672 acres) The value of the federal land would exceed the value of the private land offered in this exchange alternative. The difference in value exceeds the 25% cash equalization authority. The amount of cash equalization allowed is based on the value of the federal land. Additional private land would have to be offered to meet legal requirements regarding equal land value. A cash equalization payment could be used in combination with additional offered private land to meet legal requirements regarding equal land values.

Alternative C: (380 acres) The value of the federal land exceeds value of the private land offered in this exchange alternative. The difference in value is within the 25% cash equalization authority. Additional private land, cash equalization, or a combination would have to be offered to meet the legal requirements regarding equal land values.

Alternative D: (117 acres) The federal government would receive an annual rental fee for the use of federal land under special use permit. The minimum fee would be based on the fair market value of the federal land if offered on the private market. The actual fee is expected to be based on a percentage of gross income or determined using other common business practices that are generally found in the market. The federal land designated for Townsite Act acquisition in this alternative would be sold at market value based on highest and best use to a local governmental entity.

Alternative E: (96 acres) The federal government would receive an annual rental fee for the use of federal land under special use permit. The minimum fee would be based on the fair market value of the federal land if offered on the private market. The actual fee is expected to be based on a percentage of gross income or determined using other common business practices that are generally found in the market. No fee would be charged for the use of federal land for federal housing.

Alternative F: (100 acres) The federal government would receive an annual rental fee for the use of federal land under special use permit. The minimum fee would be based on the fair market value of the federal land if offered on the private market. The actual fee is expected to be based on a percentage of gross income or determined using other common business practices that are generally found in the market. The federal land designated for Townsite Act acquisition in this alternative would be sold at market value based on highest and best use to a local governmental entity. No fee would be charged for the use of federal land for federal housing.

Alternative G: (270 acres) The value of the federal land exceeds the value of the private land offered in this exchange alternative. The difference in value is within the 25% cash equalization authority. Additional private land, cash equalization, or a combination would have to be offered to meet legal requirements regarding equal land values.

Alternative H: (272 acres) The value of the federal land exceeds the value of the private land offered in this exchange alternative. The difference in value is within the 25% cash equalization authority. Additional private land, cash equalization, or a combination would have to be offered to meet legal requirements regarding equal land values.

## Mitigation and Monitoring

The following mitigation and monitoring measures generally apply to all of the action alternatives, B through H (exceptions are noted under individual measures).

### Visitor Experience in and Around Grand Canyon

(This applies to Alternatives B, C, D, G, and H)

- The developer(s) will design, fund, and implement a visitor survey, in conjunction with the Forest Service and NPS that will be conducted every three years through the year 2010 to examine visitor satisfaction at GCNP, KNF, and Tusayan.

### Air Quality

- Water or other stabilizers will be applied to unpaved road sections and disturbed ground during construction to minimize dust.

- Primary transportation corridors into GCNP and developed areas will be hard-surfaced.

- Burning of slash and other debris created from construction will be prohibited. Vegetation debris created from construction activities will be chipped and used for mulch, or hauled off-site and disposed of in approved land-fills.

- All land areas disturbed by construction activities will be re-vegetated as quickly as possible to reduce the potential for blowing dust.

- Installation and use of wood-burning stoves for heating in residential and visitor facilities will be prohibited. Exceptions include fireplaces used for aesthetic purposes in lodging facilities and businesses.

### Transportation

- The developer(s) will work in coordination with ADOT and Coconino County to prepare a transportation impact analysis to determine needed roadway improvements for the internal transportation system, and the transit provider will prepare a transportation impact analysis for access off State Highway 64.

- The developer(s) will prepare a detailed transportation plan prior to conveyance and use of NFS lands. The plan will identify all traffic circulation needs, including foot and bike paths in developed areas and routes linking developed areas with GCNP and attractions on NFS land.

### Development Plan Assurances

- The transfer of NFS land into private ownership will be conditioned upon escrow instructions specifying that the conveyance will not be completed until the following are recorded in the Coconino County land records:

  1) development agreements and the covenants, conditions, and restrictions or conservation easements ensuring that commitments in the EIS are a binding condition of the land title and apply to all future landowners. Commitments include the construction phasing schedule and proposed uses of NFS land (e.g., housing, designated open space, school site, fire station, parks, etc.).

  2) development agreements and the covenants, conditions, and restrictions or conservation easements creating a mechanism to ensure that the proposed development will generate funding necessary to fulfill commitments in the EIS in perpetuity.

### Development Agreements

(These measures apply to Alternatives B, C, G, and H.)

- The development agreement, executed between Coconino County and the developer, shall be consistent with provisions specified in the County Comprehensive Plan, the Tusayan Area Plan, and the Final Environmental Impact Statement and Record of Decision for Tusayan Growth, subject to modifications, refinements and revisions resulting from the County planning and zoning process.

The development agreement may be amended, or canceled in whole or in part, by mutual consent of the parties to the development agreement or by their successors in interest or assigns.

The burdens of the development agreement are binding on the parties to the agreement and to all their successors in interest and assigns.

The development agreement may specify or otherwise relate to any of the following:

•The duration of the agreement.
•The permitted uses of property subject to the agreement.
•The density and intensity of uses and the maximum height and size of proposed buildings within such property.
•Provisions for reservation or dedication of land for public purposes and provisions to protect environmentally sensitive land.
•The phasing or time of construction or development on property subject to the agreement.
•Conditions, terms, restrictions and requirements for public infrastructure and the financing of public infrastructure and any subsequent reimbursements over time.
•Conditions, terms, restrictions and requirements relating to the intent to form a special taxing or assessment district.
•Any other matters relating to the development of the property.

## Cultural Resources

- All cultural resource sites on NFS land will be evaluated for their eligibility for inclusion on the National Register of Historic Places. Effects to properties determined eligible will be mitigated as necessary through the implementation of a data recovery plan specific to each. Interested tribes will have an opportunity to assist in the development of these plans. Terms and conditions of the plans will be agreed upon by KNF and the State Historic Preservation Office.

## Sensitive Plant Species

- Mitigation for the Tusayan flame flower will include minimizing ground disturbance in plant population areas by incorporating these areas into green belts, buffer zones, and natural areas; fencing of plant populations to prevent encroachment during construction activities; and active monitoring of plant populations during and following construction activities by a qualified botanist.

## Special Land Uses

- Use and conveyance of NFS land will be subject to the continuation of existing easements and special use permits.

## Fire Management Programs

- The developer(s) will design, fund, and implement, in conjunction with the FS and NPS, a fuel treatment program for wildland/urban interface areas.

## Survey Markers

- The developer(s) will protect all public land survey monuments, private property corners, and Forest boundary markers. In the event that any such land markers or monuments are destroyed during construction, depending on the type of monument destroyed, the developer(s) will see that they are re-established or referenced in accordance with 1) the procedures outlined in the Manual of Instructions for the Survey of the Public Land of the United States, 2) the specifications of the county survey, or 3) the specifications of the Forest Service.

  Further, the developer(s) will cause such official survey records as are affected to be amended as provided by law. Nothing in this clause shall relieve the holder's liability for the willful destruction or modification of any government survey marker as provided at 18 U.S.C. 1858.

## Water Resources

(These measures apply to Alternatives B, C, D, and G)

- The developer(s) will prepare, fund, and implement a groundwater monitoring plan to assess the impacts of groundwater development and recharge of treated wastewater on the rate of discharge and chemical quality of groundwater issuing from selected springs along the South Rim of the Grand Canyon. This monitoring plan will be submitted to the Forest Service, NPS, and Coconino County. At a minimum, monitoring will include:

  1) periodic measurement of rate of discharge of groundwater issuing from Indian Garden, Hermit, Havasu, and Blue Springs, and from selected seeps and small springs along the South Rim of Grand Canyon;

  2) periodic collection of water samples for laboratory chemical analyses of a limited number of critical constituents (to be determined) from the springs cited above and from developer's individual groundwater supply well(s);

  3) installation of proper flow meters to measure cumulative and instantaneous flow, and periodic recording of flow data for: i) groundwater pumped from developer's individual water well(s); ii) inflow of groundwater entering the development; iii) inflow of imported water to the development; iv) inflow of raw wastewater from the development to any wastewater treatment system; and v) outflow of treated wastewater from the development to any surface water impoundments, surface water drainages, and injection wells;

  4) installation of proper groundwater level measuring devices and periodic recording of pumping and non-pumping water levels in each of developer's groundwater supply well(s); and

  5) periodic compilation and analysis of data reported by others in the Coconino Plateau groundwater sub-basin for: i) chemical quality, groundwater levels, and pumping rates for groundwater well(s); and ii) rates of discharge, chemical quality, and estimated recharge of wastewater or other discharges that would recharge groundwater.

- Monitoring of rate of discharge and chemical quality of groundwater issuing from springs along the South Rim of Grand Canyon could, entirely or in part, be implemented via the existing monitoring programs established by the NPS and USGS. Developer(s) would prepare annual reports giving results of monitoring and analysis of monitoring. At 5-year intervals, the groundwater model used in the EIS will be recalibrated based on information obtained from monitoring, projected impacts will be adjusted based on this information, and a brief report of model results will be prepared by the developer(s). These reports would be submitted to: NPS, Forest Service and ADWR; Havasupai, Hualapai, Navajo, and Hopi Tribes; and Coconino County.

- Groundwater withdrawals and sales will be managed through the establishment of a Board of Directors that will oversee groundwater pumping from CFV-controlled well(s) in Valle. The Forest Service, NPS, and Coconino County will be given a majority interest on the Board. The developer(s) will also submit the reports described above to this Board.

- The groundwater well(s) in Valle controlled by CFV will be used exclusively for potable water needs to support the CFV development and the operation of the Grand Canyon Inn in Valle.

- If results from the monitoring program indicate and verify that the developer(s) actions have negatively impacted the rate of discharge and/or chemical quality of groundwater issuing from springs and seeps along the South Rim, the developer(s) will prepare and implement a practicable contingency plan to mitigate such impacts. This plan will be submitted to the Board.

- All development will comply with Sections 401, 402, and 404 of the Clean Water Act.

## Table 2.9 Summary Comparison of Alternatives

| ALTERNATIVE COMPONENTS | ALTERNATIVE F | ALTERNATIVE G | ALTERNATIVE H |
|---|---|---|---|
| Site Acreage | •40 acres federal land allocated for local governmental acquisition under the Townsite Act<br>•10 acres federal land allocated for federal housing under MOU<br>•60 acres federal land under special use permit for transportation staging area | •270 acres federal land transferred to private ownership<br>•60 acres federal land under special use permit for transportation staging area | •272 acres federal land transferred to private ownership<br>•60 acres federal land under special use permit for transportation staging area |
| Management Action | •Special Use Permit for transportation system<br>•Townsite Act land available for community facilities<br>•MOU for federal housing | •Special Use Permit for transportation system<br>•Land Exchange: acquire private inholdings | •Special Use Permit for transportation system<br>•Land Exchange: acquire private inholdings |
| Transportation | •Mass transit system for GCNP constructed and managed under special use permit on federal land. Facilities consist of:<br>1. Parking 2. Transit center<br>3. Rail system | •Mass transit system for GCNP constructed and managed under special use permit on federal land. Facilities consist of:<br>1. Parking 2. Transit center<br>3. Rail system | •Mass transit system for GCNP constructed and managed under special use permit on federal land. Facilities consist of:<br>1. Parking 2. Transit center<br>3. Rail system |
| Lodging Units | •None | •900 rooms<br>•no phasing schedule | •1,220 rooms<br>•50 hostel-type beds<br>•900 rooms year 1; 370 rooms year 2 |

| ALTERNATIVE COMPONENTS | ALTERNATIVE F | ALTERNATIVE G | ALTERNATIVE H |
|---|---|---|---|
| Retail/Food and Beverage Space | •Transit Center: up to 2,000 sq ft of retail within larger transit building (authorized under special use permit). Product oriented towards visitor needs and convenience (i.e. prepared food items, bottled water, film, etc.) | •TOTAL: 202,000 sq ft<br>•Transit Center: up to 2,000 sq ft of retail within larger transit building (authorized under special use permit). Product oriented towards visitor needs and convenience (i.e. prepared food items, bottled water, film, etc.)<br>•Neighborhood: not less than 40,000 sq ft<br>•Visitor: not more than 160,000 sq ft (a portion of this is included at INSIGHT) | TOTAL: 272,000 sq ft<br>•Transit Center: up to 2,000 sq ft of retail within larger transit building (authorized under special use permit). Product oriented towards visitor needs and convenience (i.e. prepared food items, bottled water, film, etc.)<br>•Neighborhood: not less than 40,000 sq ft<br>•Visitor: not more than 210,000 sq ft (a portion of this is included at INSIGHT)<br>•Native Amer. Market Place: 20,000 sq ft |
| Office Space | •None | •Up to 20,000 sq ft | •Up to 20,000 sq ft |
| Housing | •100 units of housing for federal employees constructed and managed by NPS or transit provider | •CFV builds and manages an estimated 434 units for CFV employees<br>•CFV leases 20 acres of improved land to NPS at market rate for NPS and/or park concessionaire housing<br>•CFV initially provides 50 trailer/ manufactured home pads for lease to area residents at market rate<br>•No stand alone single-family housing units | •CFV builds and manages an estimated 517 units for CFV employees<br>•CFV leases 20 acres of improved land to NPS at market rate for NPS and/or park concessionaire housing<br>•CFV initially provides 50 townhomes or garden units for sale or lease to area residents at market or subsidized rate<br>•No stand alone single-family housing units |

| ALTERNATIVE COMPONENTS | ALTERNATIVE F | ALTERNATIVE G | ALTERNATIVE H |
|---|---|---|---|
| Community Facilities | •School: 27 acres unimproved land available for sale at market rate to school district<br>•13 acres of unimproved land for community facilities available for sale at market rate to qualifying users for these purposes:<br>1. Police/Fire Station 2. Library<br>3. Community Center | •School: 21 acres improved land donated by CFV<br>•Playground/Open Areas imbedded in residential areas and provided by CFV<br>•Improved land/building space available for sale/lease at market rate for these purposes:<br>1. Worship 2. Cemetery<br>3. Medical Clinic 4. Police/Fire Station<br>5. Library<br>•Community Center: 4,000 sq ft facility built and managed by CFV | •School: 21 acres improved land donated<br>•Playground/Open Areas imbedded in residential areas and provided by CFV<br>•Improved land/building space available for sale/lease at market rate for these purposes:<br>1. Worship 2. Cemetery<br>3. Medical Clinic 4. Library<br>•Police/Fire: built, equipped, and donated by CFV at no cost to Coconino County or end user<br>•Community Center: 4,000 sq ft facility built and managed by CFV |
| Design Features | •This alternative was designed to meet standards established in the Tusayan Area Plan | •This alternative was designed to meet or exceed standards established in the Tusayan Area Plan. Although not a primary consideration, this alternative incorporates sustainable design elements where economically feasible | •This alternative was designed to incorporate ideas of self-sufficiency, efficiency of use, durability of materials, resource conservation, and aesthetics |

| ALTERNATIVE COMPONENTS | ALTERNATIVE F | ALTERNATIVE G | ALTERNATIVE H |
|---|---|---|---|
| Sustainable Design Elements | •Water conservation measures would comply with county regulations. Multi-family residences would be dual-plumbed to allow for use of treated wastewater for flushing toilets and irrigation<br>•Electricity would be used as primary energy source. All utilities would be buried, unless otherwise approved by Coconino County Board of Supervisors or other approving agencies. Natural gas is not proposed for use as an energy source. Passive solar would be implemented when economically and technically feasible<br>•LEED Rating: Falls below minimum LEED™ rating | •Water conservation measures would comply with county regulations. Water harvesting would be limited to collection from parking areas for nonpotable use at transit center. Commercial lodging and multi-family residences would be dual-plumbed to allow for use of treated wastewater for flushing toilets and irrigation<br>•Electricity would be used as primary energy source. All utilities would be buried. Natural gas may be piped to CFV from Red Lake along an existing corridor. Passive solar would be implemented when economically feasible<br>•LEED Rating: Falls below minimum LEED™ rating | •Maximum water conservation measures would be implemented, including xeriscaping; irrigation with reclaimed water; treatment of reclaimed water for potable use; water harvesting from parking areas and roof tops; maximum water conservation fixtures in all structures; and no bath tubs in dormitories and a minimum of 25% of the lodging units. Commercial lodging and multi-family residences would be dual-plumbed to allow for use of treated wastewater for flushing toilets and irrigation<br>•Electricity would be used as primary energy source. All utilities would be buried. Natural gas may be piped to CFV from Red Lake along an existing corridor. No less than 10% of energy needs would be met through active and passive solar systems<br>•LEED Rating: Silver |
| Dedicated Open Space | •Long Jim Canyon is allocated for transportation system (including potential future rail connection with Grand Canyon Airport) | •26% of total land allocation<br>•Long Jim Canyon is allocated for transportation system (including potential future rail connection with Grand Canyon Airport) and wastewater facility | •26% of total land allocation<br>•Long Jim Canyon is allocated for transportation system (including potential future rail connection with Grand Canyon Airport) and wastewater facility |
| Night Lighting | •Zone III (county ordinance) specified in the County Zoning Ordinance<br>•Night lighting accomplished by using conventional street lights | •Zone III (county ordinance) specified in the County Zoning Ordinance<br>•Night lighting accomplished by using conventional street lights | •Zone II (county ordinance) specified in the County Zoning Ordinance, exceeds county standards.<br>•Night lighting accomplished by using sky-shields, and low-level fixtures |

| ALTERNATIVE COMPONENTS | ALTERNATIVE F | ALTERNATIVE G | ALTERNATIVE H |
|---|---|---|---|
| Parking | •Transit center parking lot est. 3,500 spaces built on federal land and managed by transit provider. Number of spaces determined by NPS<br>•Additional federal land available for future parking needs. Constructed and managed by transit provider<br>•Parking cost reflected in mass transit user fee | •Transit center parking lot est. 3,500 spaces built on federal land and managed by transit provider. Number of spaces determined by NPS<br>•Phase II: est. 2,500 spaces built on 30 acres of private land by CFV and managed by transit provider or CFV through agreement. Number of spaces determined by the County through zoning process<br>•Parking for INSIGHT facility would be provided in the Phase II parking area<br>•All lodging facilities (except at Village Core) and residential areas in CFV have on-site parking<br>•Village core retail and lodging guests can use Phase I parking on federal land, GCNP visitors can use Phase II parking on CFV land<br>•Parking cost partially absorbed by private sector and not built into transit user fee | •Transit center parking lot est. 3,500 spaces built on federal land and managed by transit provider. Number of spaces determined by NPS<br>•Phase II: est. 2,500 spaces built on 19 acres with construction of an at-grade or architectural bi-level parking structure on private land by CFV and managed by transit provider or CFV through agreement. Number of spaces determined by the County through zoning process<br>•Parking for INSIGHT facility would be provided in the Phase II parking area<br>•All lodging facilities (except at Village Core) and residential areas in CFV have on-site parking<br>•Village core retail and lodging guests can use Phase I parking on federal land, GCNP visitors can use Phase II parking on CFV land<br>•Parking cost partially absorbed by private sector and not built into transit user fee |

| ALTERNATIVE COMPONENTS | ALTERNATIVE F | ALTERNATIVE G | ALTERNATIVE H |
|---|---|---|---|
| Water Supply | •Total estimated water needs: 29 mgy for transportation facilities and federal housing.<br>1. Water harvesting (5 mgy)<br>2. Water reuse (17 mgy)<br>3. Water supplied from GCNP (7 mgy)<br>•Potable water piped underground by NPS to transit center and federal housing<br>•Nonpotable water supplied by water collection from transit center parking lot and South Grand Canyon Sanitary District<br>•Potable and nonpotable water for community facilities purchased or supplied from outside sources, including existing water systems in Tusayan (existing wells or hauled by truck) | •Total estimated water needs: 86 mgy<br>1. Groundwater (48 mgy)<br>2. Hauled water (emergency source)<br>3. Water harvesting (5 mgy)<br>4. Water reuse (31 mgy)<br>5. Water supplied from GCNP (2 mgy)<br>•Groundwater derived from one existing well in Valle is primary water source. Additional potable water supplied by 1) retrofitting existing well in Valle to increase its capacity, 2) providing additional on-site storage capacity to accommodate peak season needs, 3) purchasing additional water from GCNP water system, and 4) purchasing water from outlying communities. Water demand could be reduced by implementing additional water conservation measures funded through the Kaibab Institute. Groundwater pumping from CFV-controlled well in Valle capped at 48 mgy through voluntary agreement between Forest Service, NPS, Coconino County, and CFV<br>•Potable water hauled by NPS to transit center<br>•Nonpotable water supplied by water collection from transit center parking lot, South Grand Canyon Sanitary District, and CFV wastewater treatment facilities | •Total estimated water needs: 77 mgy<br>1. Co. River water (44 mgy)<br>2. Groundwater (emergency source)<br>3. Water harvesting (23 mgy)<br>4. Water reuse (26 mgy)<br>5. Water supplied from GCNP (2 mgy)<br>•Co. River water is primary water source<br>•Water harvesting supplies potable water (~18 mgy) for CFV and nonpotable water (~5 mgy) for transit center<br>•Additional water obtained from water harvesting for potable use at CFV would reduce amount of Co. River water<br>•Water reuse supplies nonpotable water (~13 mgy) for CFV and nonpotable water (~13 mgy) for transit center<br>•Pumping groundwater from the existing well in Valle is restricted to emergency use only<br>•Through excess water contract w/CAWCD, CFV buys excess CAP water and banks in underground aquifer in Maricopa county in exchange for water credits<br>•CFV purchases 5th priority water from Co. River during surplus years. When 5th priority water is unavailable, CFV exchanges CAWCD water credits for Co. River water. All Co. River water is drawn from wells near Topock, AZ<br>•Co. River water hauled via railcar from Topock to Maine Siding, 8 mi. east of Williams<br>•Water delivery options: 1) Water is trained from Maine Siding to Apex Siding and piped from Apex to CFV using existing disturbed land where possible. Pumping station at Apex is within Railroad ROW 2) Water is piped from Maine Siding to CFV along Hwy 64 corridor |

| ALTERNATIVE COMPONENTS | ALTERNATIVE F | ALTERNATIVE G | ALTERNATIVE H |
|---|---|---|---|
| American Indian Involvement | •None | •INSIGHT: The exhibits will display information about the traditions of Native inhabitants, and the recent changes that have occurred to their lifestyle since European occupation. INSIGHT will provide opportunities for dialogue between visitors and American Indian scholars. Native creation stories may be expressed by traditional religious leaders and contemporary artists. The performance/conference spaces would allow storytelling, cultural presentations, research symposia, and powwows<br>•American Indian Training Opportunities: Training facility at INSIGHT for career-oriented employment skills. Funding assistance for trainees and housing and transportation subsidies to enable full participation<br>•American Indian economic partnerships in INSIGHT (ownership units for direct tribal investment)<br>•American Indian partnerships in lodging facilities and retail businesses | •INSIGHT: The exhibits will display information about the traditions of Native inhabitants, and the recent changes that have occurred to their lifestyle since European occupation. INSIGHT will provide opportunities for dialogue between visitors and American Indian scholars. Native creation stories may be expressed by traditional religious leaders and contemporary artists. The performance/conference spaces would allow storytelling, cultural presentations, research symposia, and powwows<br>•American Indian Training Opportunities: Training facility at INSIGHT for career-oriented employment skills. Funding assistance for trainees and housing and transportation subsidies to enable full participation<br>•American Indian economic partnerships in INSIGHT (ownership units for direct tribal investment)<br>•American Indian partnerships in lodging facilities and retail businesses. More opportunities with more commercial facilities proposed<br>•2 acre Native American Marketplace adjacent to Phase II parking and INSIGHT. CFV to build Marketplace, managed by a Native American organization (such as NACA), and donated to that organization at no cost. Marketplace includes a common indoor/outdoor market for cultural wares and traditional foods. Revenue above NACA management fee would be retained by involved entrepreneurs |

| ALTERNATIVE COMPONENTS | ALTERNATIVE F | ALTERNATIVE G | ALTERNATIVE H |
|---|---|---|---|
| Public/Private Partnerships | •GCNP mass transportation facilities constructed and managed by private business<br>•There are no public facilities in Tusayan (police/fire station, parks, library, community center, daycare, or worship centers). Land has not been used for these purposes. As identified in the GCNP GMP, community services will not be expanded within the park. The land base needed for these facilities would be provided with the Townsite Act land that is appraised at highest and best use<br>•The GCNP GMP identified a need for up to 500 housing units to be built near, but outside, the park. This requires a joint effort between the NPS and either private landowners in Tusayan or the Forest Service. The MOU sets aside land for federal housing<br>•Construction and operation costs of the transit center would be the responsibility of the transit provider. The federal housing could be financed by appropriated funds, increased monthly rent charged to federal employees for housing, or reallocation of GCNP entrance fees. Some financing options for the federal housing would require congressional approval | •GCNP mass transportation facilities constructed and managed by private business<br>•Land base with infrastructure or constructed building space would be donated, sold, or leased to users for a school, police/fire station, library, daycare center, park, community center, and worship centers<br>•Need for additional housing for NPS and/or park concessionaire housing met on CFV land<br>•CFV provides 50 trailer/manufactured home pads for lease to area residents<br>•Kaibab Institute established and funded through 0.1% of gross sales. Annual funding could range between $106,000 in year one to $151,000 in year 10 | •GCNP mass transportation facilities constructed and managed by private business<br>•Land base with infrastructure or constructed building space would be donated, sold, or leased to users for a school, police/fire station, library, daycare center, park, community center, and worship centers<br>•Need for additional housing for NPS and/or park concessionaire housing met on CFV land<br>•CFV provides 50 townhomes or garden units for sale or lease to area residents<br>•EPTE established and funded through 1% of gross sales. Annual funding could range between $1.3 million in year one to $1.8 million in year 10 |

| ALTERNATIVE COMPONENTS | ALTERNATIVE F | ALTERNATIVE G | ALTERNATIVE H |
|---|---|---|---|
| Education/ Orientation Facilities | •Transit Center provides basic orientation for GCNP, KNF, and outlying areas. Phone board and information station for local and regional lodging accommodations | •Transit Center provides basic orientation for GCNP, KNF, and outlying areas. Phone board and information station for local and regional lodging accommodations<br>•INSIGHT consists of a cluster of pavilion-like, interconnected facilities, encompassing ~300,000 sq ft of exhibit space, and would integrate state-of-the-art exhibits and technology . The Orientation Pavilion would begin the visitors experience at INSIGHT to preview INSIGHT's facilities. Key aspects of INSIGHT's programs and hospitality services will be a multilingual experience. Through multimedia, laser presentations, theaters, and exhibits, visitors will experience geology, hydrology, wildlife, etc. Visitors can purchase tickets for GCNP, shop in theme-based retail outlets, sample regional cuisines, and use on-site trip planning and booking services for the entire Plateau region<br>•Visitor experience can range from overview presentations to in-depth exhibits, to interactive learning centers, to performance/conference spaces<br>•For-profit orientation of INSIGHT will allow graduated participatory fees from free orientation experience and exhibits, to additional fees for in depth experiences | •Transit Center provides basic orientation for GCNP, KNF, and outlying areas. Phone board and information station for local and regional lodging accommodations<br>•INSIGHT consists of a cluster of pavilion-like, interconnected facilities, encompassing ~300,000 sq ft of exhibit space, and would integrate state-of-the-art exhibits and technology . The Orientation Pavilion would begin the visitors experience at INSIGHT to preview INSIGHT's facilities. Key aspects of INSIGHT's programs and hospitality services will be a multilingual experience. Through multimedia, laser presentations, theaters, and exhibits, visitors will experience geology, hydrology, wildlife, etc. Visitors can purchase tickets for GCNP, shop in theme-based retail outlets, sample regional cuisines, and use on-site trip planning and booking services for the entire Plateau region<br>•Visitor experience can range from overview presentations to in-depth exhibits, to interactive learning centers, to performance/conference spaces<br>•For-profit orientation of INSIGHT will allow graduated participatory fees from free orientation experience and exhibit, to additional fees for in depth experiences<br>•Additional displays and demonstration/ education center for environmental sustainable development applications |

| ALTERNATIVE COMPONENTS | ALTERNATIVE F | ALTERNATIVE G | ALTERNATIVE H |
|---|---|---|---|
| Infrastructure | •Wastewater system tied into South Grand Canyon Sanitary District<br>•Grid hook-up with APS (electric) primary source. Where implemented, passive solar would reduce energy needs<br>•Recycling of basic materials (glass, aluminum, paper) at transit center and federal housing<br>•Solid waste hauled to county transfer station east of Tusayan | •Conventional wastewater treatment facilities<br>•Grid hook-up with APS (electric) primary source. Natural gas or liquefied natural gas may supplement primary energy source. Where implemented passive solar would reduce energy needs<br>•Curb-side recycling program<br>•Solid waste hauled to Flagstaff landfill, or closest regional landfill that will accept waste | •Solar aquatic waste system for wastewater treatment. Reverse osmosis would be used for water re-use<br>•Grid hook-up with APS (electric) primary source. Natural gas or liquefied natural gas may supplement primary energy source. Ten percent of energy needs would be provided by active and passive solar systems<br>•Curb-side recycling program<br>•Solid waste hauled to Flagstaff landfill, or closest regional landfill that will accept waste<br>•Exceed ASHRAE 90.1-1989 standard by 40% |
| Pedestrian Connection | •Transit provider builds pedestrian sidewalk from transit center to IMAX on federal land | •Transit provider builds pedestrian sidewalk from transit center to IMAX on federal land<br>•CFV builds pedestrian corridor from transit center to IMAX through the CFV village core. This pedestrian corridor will be 50-100 feet-wide, with 50 feet-wide for a minimum of 50% of the linear dimension. Corridor imbedded with native landscaping and small public gathering areas. Lateral walkways connect corridor to businesses and pedestrian sidewalk. Secondary corridor through the CFV village core could potentially accommodate other transportation modes (bike path or trolley)<br>•Pedestrian corridor could continue through Tusayan, linking Tusayan lodging and retail businesses with the transit center and village core<br>•Internal pedestrian/bike trail system through CFV that eventually could link to GCNP and Tusayan | •Transit provider builds pedestrian sidewalk from transit center to IMAX on federal land<br>•CFV builds pedestrian corridor from transit center to IMAX through the CFV village core. This pedestrian corridor will be 50-100 feet-wide, with 50 feet-wide for a minimum of 50% of the linear dimension. Corridor imbedded with native landscaping and small public gathering areas. Lateral walkways connect corridor to businesses and pedestrian sidewalk. Secondary corridor through the CFV village core could potentially accommodate other transportation modes (bike path or trolley)<br>•Pedestrian corridor could continue through Tusayan, linking Tusayan lodging and retail businesses with the transit center and village core<br>•Internal pedestrian/bike trail system through CFV that eventually could link to GCNP and Tusayan |

| ALTERNATIVE COMPONENTS | ALTERNATIVE F | ALTERNATIVE G | ALTERNATIVE H |
|---|---|---|---|
| Mitigation/ Monitoring | •Cultural Resources: data recovery in coordination with Tribes and SHPO to mitigate unavoidable sites<br>•Natural Resources: Retain natural vegetation in open space | •Cultural Resources: data recovery in coordination with Tribes and SHPO to mitigate unavoidable sites<br>•Natural Resources: Retain natural vegetation in open space<br>•Water: CFV to fund monitoring program for Grand Canyon seeps and springs<br>•Groundwater withdrawals managed by Board of Directors with agency representation | •Cultural Resources: data recovery in coordination with Tribes and SHPO to mitigate unavoidable sites<br>•Natural Resources: Plant one tree per 1,000 sq ft of building and parking space. Relocate trees ≤8 ft tall within building and parking areas to Long Jim Canyon or off-site |
| Governance | •USFS/NPS special use permit stipulations<br>•Coconino County zoning requirements<br>•Townsite Act use restrictions<br>•MOU for federal housing | •USFS/NPS special use permit stipulations<br>•Establish Institute to enforce development requirements with agency representation<br>•Development agreements<br>•Coconino County zoning requirements, CC&Rs, deed restrictions, conservation easements | •USFS/NPS special use permit stipulations<br>•Establish Institute to enforce development requirements with agency representation<br>•Development agreements<br>•Coconino County zoning requirements, CC&Rs, deed restrictions, conservation easements |

## Table 2.10 Summary of Environmental Consequences

| Resource Issue *sub-issue* | Alternatives | | |
|---|---|---|---|
| | ***Alternative F:*** ***Special Use Permit/Federal Housing/Townsite Act*** | ***Alternative G:*** ***Special Use Permit/Land Exchange Option 1*** | ***Alternative H:*** ***Special Use Permit/Land Exchange Option 2*** |
| **Surface and Groundwater** *Water Supply* | •Total estimated potable water needs: 7 mgy<br><br>•Primary water source: GCNP Roaring Springs system | •Total estimated potable water needs: 50 mgy<br><br>•Primary water source: Groundwater from existing well in Valle | •Total estimated potable water needs: 46 mgy<br><br>•Primary water source: Surface water from Colorado River near Topock, AZ |
| **Surface and Groundwater** *Grand Canyon Water Resources* | •No use of groundwater<br><br>•Groundwater withdrawals from Coconino Plateau subbasin from cumulative development would decrease the rate of discharge from Grand Canyon springs between:<br>Havasu 1 and 2%<br>Indian Garden 8 and 32%<br>Hermit 5 and 19% | •Groundwater withdrawal from Coconino Plateau subbasin to supply water for proposed development would decrease the rate of discharge from Grand Canyon springs by:<br>Havasu 0.3%<br>Indian Garden 0.9%<br>Hermit 0.6%<br><br>•Groundwater withdrawals from Coconino Plateau subbasin from cumulative development would decrease the rate of discharge from Grand Canyon springs between:<br>Havasu 1 and 2%<br>Indian Garden 9 and 18%<br>Hermit 5 and 11% | •No use of groundwater<br><br>•Groundwater withdrawals from Coconino Plateau subbasin from cumulative development would decrease the rate of discharge from Grand Canyon springs between:<br>Havasu 1 and 2%<br>Indian Garden 8 and 18%<br>Hermit 5 and 11% |
| **Surface and Groundwater** *Water Transportation* | •Construction of approximately 5 miles of water pipeline from GCNP water system to site | •Construction of approximately 25 miles of water pipeline from Valle to site | •Water hauled by rail from Topock to Williams. Construction of approximately 60 miles of water pipeline from Williams to site **or** water hauled by rail from Williams to Apex with construction of approximately 4 miles of water pipeline from Apex to site |

| Resource Issue *sub-issue* | Alternatives | | |
|---|---|---|---|
| | ***Alternative F:*** ***Special Use Permit/Federal Housing/Townsite Act*** | ***Alternative G:*** ***Special Use Permit/Land Exchange Option 1*** | ***Alternative H:*** ***Special Use Permit/Land Exchange Option 2*** |
| **Socioeconomics** *Tusayan/Grand Canyon area* | •Total of 1,360 rooms could be built in Grand Canyon/Tusayan area at 2.5% visitation growth rate through 2010, based on model assumptions<br><br>•Cumulative impacts to Tusayan and GCNP off-rim lodging properties from 1998 to 2010 from development in the Grand Canyon/Tusayan area at 2.5% visitation growth rate<br><br>Average occupancy rate: 67%<br>Lowest occupancy rate: 62%<br><br>•2,000 square feet of retail proposed. This amount of retail is not expected to significantly compete with existing retail businesses in Tusayan | •Total of 1,260 rooms would be built in Grand Canyon/Tusayan area at 2.5% visitation growth rate through 2010, based on model assumptions<br><br>•Cumulative impacts to Tusayan and GCNP off-rim lodging properties from 1998 to 2010 from development in the Grand Canyon/Tusayan area at 2.5% visitation growth rate<br><br>Average occupancy rate: 62%<br>Lowest occupancy rate: 49%<br><br>•200,000 square feet of retail proposed. At 2.5% visitation growth rate, spending patterns of visitors would need to increase by 1.5 times current levels or average retail sales volumes of existing businesses in the Grand Canyon/Tusayan area would drop by 30% of existing levels. | •Total of 1,630 rooms would be built in Grand Canyon/Tusayan area at 2.5% visitation growth rate through 2010, based on model assumptions<br><br>•Cumulative impacts to Tusayan and GCNP off-rim lodging properties from 1998 to 2010 from development in the Grand Canyon/Tusayan area at 2.5% visitation growth rate<br><br>Average occupancy rate: 56%<br>Lowest occupancy rate: 47%<br><br>•270,000 square feet of retail proposed. At 2.5% visitation growth rate, spending patterns of visitors would need to increase by 1.7 times current levels or average retail sales volumes of existing businesses in the Grand Canyon/Tusayan area would drop by 40% of existing levels. |
| **Socioeconomics** *Other Outlying Communities* | •Penetration rate in the Grand Canyon/Tusayan area increases from 31.5 to 35%<br><br>•Cumulative impact to northern Arizona from 1998-2010 at 2.5% visitation growth rate, 70% occupancy rate, at 50 and 90% displacement factors:<br><br>Total displaced rooms: 132 to 238 rooms<br>Total displaced spending: $4.7 to $8.5 million<br>Total lost taxes: $137,000 to $247,000 | •Penetration rate in the Grand Canyon/Tusayan area increases from 31.5 to 35%<br><br>•Cumulative impact to northern Arizona from 1998-2010 at 2.5% visitation growth rate, 70% occupancy rate, at 50 and 90% displacement factors:<br><br>Total displaced rooms: 132 to 238 rooms<br>Total displaced spending: $4.7 to $8.5 million<br>Total lost taxes: $137,000 to $247,000 | •Penetration rate in the Grand Canyon/Tusayan area increases from 31.5 to 35%<br><br>•Cumulative impact to northern Arizona from 1998-2010 at 2.5% visitation growth rate, 70% occupancy rate, at 50 and 90% displacement factors:<br><br>Total displaced rooms: 132 to 238 rooms<br>Total displaced spending: $4.7 to $8.5 million<br>Total lost taxes: $137,000 to $247,000 |
| **Socioeconomics** *Housing* | •Does not satisfy need expressed in GMP for park concessionaire housing<br><br>•Does not satisfy need for Tusayan area employee housing | •Satisfies need expressed in GMP for NPS and park concessionaire housing<br><br>•Partially satisfies need for Tusayan area employee housing through lease of trailer/manufactured home pads at market rate | •Satisfies need expressed in GMP for NPS and park concessionaire housing<br><br>•Partially satisfies need for Tusayan area employee housing through lease or sale of townhomes or garden units at market or subsidized rate |

| Resource Issue *sub-issue* | Alternatives | | |
|---|---|---|---|
| | ***Alternative F:*** ***Special Use Permit/Federal Housing/Townsite Act*** | ***Alternative G:*** ***Special Use Permit/Land Exchange Option 1*** | ***Alternative H:*** ***Special Use Permit/Land Exchange Option 2*** |
| **Socioeconomics** *Employment Opportunities* | •An estimated 71 new jobs generated | •An estimated 1,031 new jobs generated | •An estimated 1,337 new jobs generated |
| **Socioeconomics** *Crime Rates* | •Unimproved NFS land available for sale at market value under the Townsite Act to construct a police/fire station<br><br>•No funding provided to purchase land, construct infrastructure and building, or equip the police/fire station<br><br>•Emergency response time remains unchanged | •Improved land or building space available for lease at market rate to construct a police/fire station<br><br>•No funding provided to construct building or equip the police/fire station<br><br>•If police/fire station built, it would reduce emergency response time | •Police/fire station built, equipped, and donated by CFV to Coconino County and Tusayan Fire District<br><br>•Police/fire station in Tusayan would reduce emergency response time |
| **Socioeconomics** *Community Infrastructure* | •Unimproved land available for sale at market value under the Townsite Act for various community uses<br><br>•Proposed facilities would tie into existing wastewater treatment plant in Tusayan<br><br>•17,400 pounds of solid waste generated daily and hauled to Tusayan transfer station. Basic recycling program implemented<br><br>•Increased payments to county from revenue generated at transit center | •Improved land or building space donated or available for lease at market rate for various community uses<br><br>•New wastewater treatment plant constructed by CFV<br><br>•25,000 pounds of solid waste generated daily and hauled from CFV to Flagstaff landfill. Curb-side recycling program implemented<br><br>•Increased payments to county from revenue generated at transit center. Additional tax revenue from CFV development | •Improved land or building space donated or available for lease at market rate for various community uses<br><br>•Biological wastewater treatment plant (solar aquatic system) constructed by CFV<br><br>•20,000 pounds of solid waste generated daily and hauled from CFV to Flagstaff landfill. CFV commitment to reduce on-site solid waste generation by 75%<br><br>•Increased payments to county from revenue generated at transit center. Additional tax revenue from CFV development |
| **Visitor Experience** *Grand Canyon Experience* | •Visitor experience improved from development of transit center | •Visitor experience improved from development of transit center, INSIGHT, and additional visitor facilities at CFV | •Visitor experience improved from development of transit center, INSIGHT, Native American marketplace, and additional visitor facilities at CFV |

| Resource Issue *sub-issue* | Alternatives | | |
|---|---|---|---|
| | ***Alternative F:*** ***Special Use Permit/Federal Housing/Townsite Act*** | ***Alternative G:*** ***Special Use Permit/Land Exchange Option 1*** | ***Alternative H:*** ***Special Use Permit/Land Exchange Option 2*** |
| **Visitor Experience** *Visual Quality* | •View from State Highway 64 north of Tusayan would be altered from development of Grand Canyon Transit Center<br><br>•View from State Highway 64 south of Desert View would be altered from development of Lower Basin private inholding<br><br>•Visual impacts of development addressed by adopting common architectural theme and preserving native vegetation | •View from State Highway 64 north of Tusayan would be altered from development of Grand Canyon Transit Center and CFV<br><br>•Private inholdings controlled by CFV would be acquired and precluded from development<br><br>•Visual impacts of development addressed by adopting common architectural theme, preserving native vegetation, and designating 26% of area to open space | •View from State Highway 64 north of Tusayan would be altered from development of Grand Canyon Transit Center and CFV<br><br>•Private inholdings controlled by CFV would be acquired and precluded from development<br><br>•Visual impacts of development addressed by adopting common architectural theme, preserving native vegetation, and designating 26% of area to open space |
| **Visitor Experience** *Air Quality* | •Vehicle emission in GCNP reduced by restricting use of private vehicles in park and developing mass transit system<br><br>•Short-term reduction in air quality during construction of transit center | •Vehicle emission in GCNP reduced by restricting use of private vehicles in park and developing mass transit system<br><br>•Short-term reduction in air quality during construction of transit center and CFV | •Vehicle emission in GCNP reduced by restricting use of private vehicles in park and developing mass transit system<br><br>•Short-term reduction in air quality during construction of transit center and CFV |
| **Visitor Experience** *Light Pollution* | •Night sky glow would not increase noticeably over existing background levels at GCNP overlooks | •Night sky glow would be visible up to 8.6 miles from Tusayan, impacting night-time views at several GCNP overlooks | •Night sky glow would be visible up to 8.3 miles from Tusayan, impacting night-time views at several GCNP overlooks |
| **Visitor Experience** *Noise* | •Ambient noise level in Tusayan would increase from development of transit center<br><br>•Ambient noise level in GCNP would decrease by restricting use of private vehicles in park and from development of mass transit system<br><br>•Ambient noise level at Desert View would increase with additional visitor traffic from development of Lower Basin private inholding | •Ambient noise level in Tusayan would increase from development of transit center and CFV<br><br>•Ambient noise level in GCNP would decrease by restricting use of private vehicles in park and from development of mass transit system | •Ambient noise level in Tusayan would increase from development of transit center and CFV<br><br>•Ambient noise level in GCNP would decrease by restricting use of private vehicles in park and from development of mass transit system |

| Resource Issue *sub-issue* | Alternatives | | |
|---|---|---|---|
| | ***Alternative F:*** ***Special Use Permit/Federal Housing/Townsite Act*** | ***Alternative G:*** ***Special Use Permit/Land Exchange Option 1*** | ***Alternative H:*** ***Special Use Permit/Land Exchange Option 2*** |
| **Visitor Experience** *GCNP Management* | •Needs expressed in GCNP GMP met by providing:<br>NFS land for transit center<br>NFS land for NPS housing<br>NFS land for community facilities | •Needs expressed in GCNP GMP met by providing:<br>NFS land for transit center<br>30 acres improved land in CFV for NPS and park concessionaire housing<br>Improved land or building space in CFV for community facilities | •Needs expressed in GCNP GMP met by providing:<br>NFS land for transit center<br>30 acres improved land in CFV for NPS and park concessionaire housing<br>Improved land or building space in CFV for community facilities |
| **Visitor Experience** *GCNP Visitation* | •Length of visitor stay in GCNP would not be expected to change substantially from development of mass transit system<br>•Visitor amenities at transit center would not increase length of visitor stay in Tusayan | •Length of visitor stay in GCNP would not be expected to change substantially from development of mass transit system<br>•Visitor amenities at transit center and CFV would increase length of visitor stay in Tusayan | •Length of visitor stay in GCNP would not be expected to change substantially from development of mass transit system<br>•Visitor amenities at transit center and CFV would increase length of visitor stay in Tusayan |
| **Transportation** | •Mass transit system relieves traffic congestion in GCNP | •Mass transit system relieves traffic congestion in GCNP | •Mass transit system relieves traffic congestion in GCNP |
| **Development Plan Assurances** | •No assurance that NFS land would be purchased, infrastructure developed, and facilities constructed for community purposes<br>•Development of transit center is contingent on obtaining private enterprise to construct and manage transportation facilities under special use permit<br>•Development of NPS housing is contingent on NPS securing funds | •No assurance that improved land or building space would be leased or purchased, and facilities constructed for community purposes (except community center and neighborhood parks)<br>•Development of transit center is contingent on obtaining private enterprise to construct and manage transportation facilities under special use permit<br>•Development of NPS housing is contingent on NPS securing funds | •No assurance that improved land or building space would be leased or purchased, and facilities constructed for community purposes (except community center, neighborhood parks and police/fire station)<br>•Development of transit center is contingent on obtaining private enterprise to construct and manage transportation facilities under special use permit<br>•Development of NPS housing is contingent on NPS securing funds |

| Resource Issue *sub-issue* | Alternatives | | |
|---|---|---|---|
| | ***Alternative F:*** ***Special Use Permit/Federal Housing/Townsite Act*** | ***Alternative G:*** ***Special Use Permit/Land Exchange Option 1*** | ***Alternative H:*** ***Special Use Permit/Land Exchange Option 2*** |
| **Cultural Resources** | •Number of cultural resource sites within development area that may require mitigation: 1<br><br>•Number of cultural resource sites in private inholdings acquired through land exchange: 0 | •Number of cultural resource sites within development area that may require mitigation: 4<br><br>•Number of cultural resource sites in private inholdings acquired through land exchange: 102 | •Number of cultural resource sites within development area that may require mitigation: 4<br><br>•Number of cultural resource sites in private inholdings acquired through land exchange: 102 |
| **Biological Resources** *Vegetation* | •Up to 110 acres of vegetation removed from development of NFS land | •Up to 237 acres of vegetation removed from development of NFS land | •Up to 239 acres of vegetation removed from development of NFS land |
| **Biological Resources** *Wildlife* | •Development of NFS land and private inholdings would create pockets of development that could fragment wildlife habitat within Tusayan Ranger District, resulting in greater zone of influence from human disturbance | •Through federal acquisition of private inholdings, development is concentrated in Tusayan, resulting in smaller zone of influence from human disturbance | •Through federal acquisition of private inholdings, development is concentrated in Tusayan, resulting in smaller zone of influence from human disturbance |
| **Biological Resources** *Special Interest Species* | •No known federally listed plant or animal species would be affected on NFS land<br><br>•Development of Kotzin, TenX, and Lower Basin private inholdings could affect known populations of: Arizona leatherflower (federal candidate) and Tusayan flameflower (Forest Service sensitive) | •No known federally listed plant or animal species would be affected on NFS land<br><br>•Development of NFS land could affect Tusayan flameflower (Forest Service sensitive)<br><br>•Acquisition of private inholdings would protect known populations of Arizona leatherflower (federal candidate), Tusayan flameflower (Forest Service sensitive), disturbed rabbitbrush (Forest Service sensitive), and potential habitat for northern goshawk, flammulated owl, Navajo Mountain Mexican vole, and occult little brown bat (all Forest Service sensitive) | •No known federally listed plant or animal species would be affected on NFS land<br><br>•Development of NFS land could affect Tusayan flameflower (Forest Service sensitive)<br><br>•Acquisition of private inholdings would protect known populations of Arizona leatherflower (federal candidate), Tusayan flameflower (Forest Service sensitive), disturbed rabbitbrush (Forest Service sensitive), and potential habitat for northern goshawk, flammulated owl, Navajo Mountain Mexican vole, and occult little brown bat (all Forest Service sensitive) |
| **KNF Management** *Management Objectives* | •Forest Service does not acquire private inholdings in Tusayan Ranger District | •Forest Service acquires 12 private inholdings in Tusayan Ranger District | •Forest Service acquires 12 private inholdings in Tusayan Ranger District |

| Resource Issue *sub-issue* | Alternatives | | |
|---|---|---|---|
| | ***Alternative F:*** ***Special Use Permit/Federal Housing/Townsite Act*** | ***Alternative G:*** ***Special Use Permit/Land Exchange Option 1*** | ***Alternative H:*** ***Special Use Permit/Land Exchange Option 2*** |
| **KNF Management** *Public Recreation Opportunities* | •Proposed development would not affect plans for potential expansion of TenX campground | •Proposed development would not affect plans for potential expansion of TenX campground | •Proposed development would not affect plans for potential expansion of TenX campground |
| **KNF Management** *Fire Management Programs* | •Development of NFS land and private inholdings would result in additional wildland/urban interface, and would increase fire risk from new population in areas previously undeveloped | •Development of NFS land would increase wildland/urban interface in Tusayan area. Federal acquisition of private inholdings would reduce potential for additional wildland/urban interface | •Development of NFS land would increase wildland/urban interface in Tusayan area. Federal acquisition of private inholdings would reduce potential for additional wildland/urban interface |

# Chapter 3 Affected Environment



## Introduction

The information in this chapter describes the physical, biological, social, and economic aspects of the environment that has changed since publication of the draft EIS. The information represents more detailed knowledge developed since that time. Generally, the new information in the chapter relates to the hydrogeologic and economic analyses. The revised technical reports that support this information are published in an Appendix to this document.

## Existing Conditions Related to Issues and Concerns

### Surface and Groundwater

#### Water Supply

##### Wells Within the Coconino Plateau Groundwater Subbasin

During hydrology analysis for draft EIS, five active wells were withdrawing groundwater from the Redwall-Muav aquifer in the Coconino Plateau groundwater subbasin. Two of these active wells are in Tusayan, two wells are in Valle, and one well is at the Canyon Mine site. Tusayan is about six miles south of the South Rim of Grand Canyon; Valle is about 25 miles south of the South Rim of Grand Canyon; and Canyon Mine is about six miles south-southeast from Tusayan, or about 9 miles from the nearest part of the South Rim. During 1996 and 1997, three additional wells were constructed to withdraw groundwater from the Redwall-Muav aquifer, including: 1) a third well constructed in Tusayan; 2) a well constructed for the Havasupai Tribe at Tunnel Canyon, located on the west rim of Cataract Canyon near Hualapai Hilltop and about 4 miles from Havasu Springs; and 3) a well constructed east from Williams, located about 55 miles south from the South Rim. In addition, a fourth well is planned for construction at Tusayan. Total reported design pumping capacity for the existing and planned wells is 565 gallons per minute (gpm), or nearly 300 million gallons per year (mgy). Table 3.1 presents the records of existing and planned wells withdrawing groundwater from the Redwall-Muav aquifer.

#### Groundwater Level Altitude

Data for groundwater levels in wells measured prior to early 1995, when data compilation for the draft EIS groundwater flow model was completed, were used to develop targets for calibration of the steady-state groundwater flow model. Measured and simulated groundwater levels at wells that are completed in the Redwall-Muav aquifer in the subbasin are summarized in Table 3.2. The two existing Valle wells are near each other and have similar measured water levels; the average of measured groundwater levels for these wells is about 3,500 feet above mean sea level (msl) and was the calibration target for the draft EIS groundwater flow model in the Valle area. The groundwater level measured in July 1993 for the Canyon Mine well is 3,971 feet msl and was the model calibration target for the well at the Canyon Mine site. The two Tusayan wells are a short distance apart and have similar measured water levels; the average of measured groundwater levels for these wells is 4,200 feet msl and was the calibration target for the model in the Tusayan area.

Although differences occur between measured and simulated groundwater levels, the general trends and patterns of simulated groundwater levels are similar to trends and patterns of measured groundwater levels, and conform with the conceptual model for the region.

#### Grand Canyon Water Resources

##### Regional Aquifer

The Redwall-Muav aquifer is the only aquifer of regional extent that is capable of consistently yielding large quantities of groundwater to wells and springs in the Coconino Plateau groundwater subbasin. The Redwall-Muav aquifer consists of, in descending order, the Redwall Limestone, Temple Butte Formation, and Muav Limestone. In addition, undifferentiated Cambrian rocks, that comprise a sequence of dolostone, overlie the Muav Limestone and are part of the Redwall-Muav aquifer system.

Outflow from the Redwall-Muav aquifer in the Coconino Plateau groundwater subbasin is known to a relatively large degree of certainty. More than 98% of the reported groundwater outflow occurs at Havasu, Indian Garden, and Hermit Springs. Groundwater from the regional Redwall-Muav aquifer in the subbasin discharges chiefly at Havasu Springs.

**Table 3.1 Records for Existing and Planned Wells, Redwall-Muav Aquifer Coconino Plateau Groundwater Subbasin**

| Site | Well Location | Status | Data Source[1] | Date Completed | Design Pumping Capacity (gpm) | Well Yield (gpm) | Total Depth Drilled (feet)[2] |
|---|---|---|---|---|---|---|---|
| Tusayan | (A-30-02) 24caa | Existing | ADWR | 05-01-89 | 80 | N/R | 3,108 |
| Tusayan | (A-30-02) 24bac | Existing | ADWR | 05-03-94 | 80 | N/R | 3,000 |
| Tusayan | (A-30-02) 24aac | Existing | ADWR[3] | 01-98 | 100 | 25 | 3,150 |
| Tusayan | (A-30-02) 24acd | Planned | ADWR | --- | 100 | --- | 3,400 |
| Valle | (A-26-02) 11ddc | Existing | ADWR | 06-15-94 | 85 | 89 | 3,450 |
| Valle | (A-26-02) 01cdd | Existing | ADWR | 12-26-94 | 80 | 41 | 3,200 |
| Tunnel Canyon | (B-32-04) 24cd | Existing | USBR | 12-96 | N/R | 50 | 3,115 |
| Williams | (A-22-03) 30ccd | Under Construction | M&A | --- | N/R | 45 | 3,540 |
| Quivero | (A-25-02) 27aba | Abandoned | USGS | 12-69 | N/R | 26 | 3,665 |
| Canyon Mine | (A-29-03) 20bcd | Existing | M&A | 1986 | 5 | 5 | 3,086 |

Notes:
--- = Not applicable
N/R = Not reported

[1] Data Sources:
ADWR = Arizona Department of Water Resources
USBR = United States Bureau of Reclamation
M&A = Errol L. Montgomery and Associates, Inc., files
USGS = United States Geological Survey

[2] Feet below land surface

[3] Mancra Inc. provided data for reported yield, depth drilled, casing, and depth to groundwater level.

**Table 3.2 Groundwater Level Altitudes for Wells in the Coconino Plateau Groundwater Subbasin**

| Well Identifier | Location | Groundwater Level Altitude (Feet, msl) Measured | Simulated | Calibration Residual (Feet) |
|---|---|---|---|---|
| *(B-32-4)24cd* | *Tunnel Canyon*[1] | *3,310* | *3,380* | *70* |
| *(A-22-3)30ccd* | *East of Williams* | *3,968* | *3,900* | *68* |
| (A-25-2)27aba | Quivero | >3,327[2] | 3,770 | — |
| (A-26-2)01cdd | Valle | 3,550 | 3,762 | 212 |
| (A-26-2)11ddc | Valle | 3,450 | 3,762 | 312 |
| (A-29-3)20bcd | Canyon Mine | 3,971 | 3,844 | -127 |
| *(A-30-2)24aac* | *Tusayan* | *4,150* | *3,843* | *-307* |
| (A-30-2)24bac | Tusayan | 4,200 | 3,843 | -357 |
| (A-30-2)24caa | Tusayan | 4,155 | 3,843 | -312 |

1. Near Supai, Arizona
2. Measured groundwater level is not considered to be representative for the Redwall-Muav aquifer

*Italicized entries are for wells constructed to be representative for the Redwall-Muav aquifer*

### Coconino Plateau Groundwater Subbasin

Lateral boundaries for the Coconino Plateau groundwater subbasin are groundwater barriers in some areas and are groundwater divides in other areas. Although recharge that occurs near each boundary moves in generally opposite directions from the boundary, some of the boundaries are barriers to groundwater flow in the saturated zone of the Redwall-Muav aquifer. Groundwater barriers generally are immobile and commonly consist of poorly permeable rocks located within or adjacent to aquifers, or areas where saturated thickness of an aquifer thins to extinction. For example, in areas of geologic structural uplift or faulting, the base of a lithologic unit that forms a regional aquifer can locally lie above the saturated zone. Groundwater barriers can correspond with locations for faults, folds, or lithologic contacts. A groundwater divide is a groundwater level "high", from which groundwater in the saturated zone of an aquifer moves in generally opposite directions toward areas of lower groundwater levels. When groundwater level drawdown resulting from a stress on an aquifer, such as a pumping well, reaches a groundwater barrier, rate of drawdown in the well and in the aquifer increases. A groundwater divide can move in response to aquifer stresses, effectively expanding a groundwater basin when groundwater withdrawals from the basin increase. Lateral boundaries for the Coconino Plateau groundwater subbasin consist of groundwater barriers on the north and west and groundwater divides on the east and south.

The Redwall-Muav aquifer in the Coconino Plateau groundwater subbasin is bounded on the north by the Grand Canyon, which is deeper than the base of the Redwall-Muav aquifer and is the area of natural discharge. The formations that comprise the Redwall-Muav aquifer are exposed in the walls of Grand Canyon and its tributary canyons. Saturated thickness in the Redwall-Muav aquifer thins to extinction toward Grand Canyon (Metzger 1961). At some locations along the South Rim, a groundwater divide may occur between the regional Redwall-Muav aquifer and small near-rim drainage basins that feed seeps and springs.

The subbasin is bounded on the south by a groundwater divide. South from this divide, groundwater drains southward to the Verde Valley (Cooley 1963). The subbasin is bounded on the west by a groundwater barrier formed by the Toroweap and Aubrey fault systems. Due to structural uplift of the Redwall-Muav aquifer east from these fault systems, saturated thickness in the aquifer thins to extinction toward this boundary (Twenter 1962, Montgomery & Associates 1992).

The subbasin is bounded on the east by a groundwater divide and, possibly, by a groundwater barrier. East from this boundary, groundwater drains to Blue Springs along the Little Colorado River (Huntoon 1982); Blue Springs and the Little Colorado River drain the Black Mesa hydrologic basin, which comprises a large region extending across northeast Arizona and into New Mexico. The east boundary of the model was located from geologic structural features observed at the South Rim, at land surface, and on aerial photos and satellite imagery. The south part of this boundary is a groundwater divide extending north from near Parks, west from the San Francisco Peaks. The occurrence of this boundary has been reported by previous investigators, including the USGS (Cooley 1963). The north part of the east boundary is a groundwater divide and/or groundwater barrier.

The basal boundary for the Redwall-Muav aquifer in the Coconino Plateau groundwater subbasin consists of the Bright Angel Shale, which is not permeable. Where the total thickness of the Redwall-Muav aquifer is not completely saturated, the upper boundary of the aquifer consists of the groundwater table or poorly permeable strata of the Redwall Limestone. Where the complete thickness of the Redwall-Muav aquifer is saturated, the upper boundary of the aquifer is the base of poorly-permeable fine-grained units of the overlying Supai Group.

### Structural Features

Fracture systems associated with principal structural features function as conduits for recharge, transmission, and discharge of groundwater in the Redwall-Muav aquifer. Recharge from precipitation and ephemeral streamflow infiltrates downward through fracture systems associated with principal structural features. The groundwater has dissolved some of the carbonate rock in the Redwall-Muav aquifer to form cavernous conduits that transmit large quantities of groundwater (Huntoon 1982). These conduits are referred to in the draft EIS and in the revised hydrogeologic technical report as solution-enhanced permeability features or solution features. Solution features preferentially develop parallel to the direction of the hydraulic gradient between points of recharge and points of discharge, especially along extensional fractures, groundwater movement, and faults that are aligned with the hydraulic gradient.

Groundwater discharged from the Redwall-Muav aquifer issues from springs located near principal structural features in Grand Canyon and its tributary canyons. Most of the groundwater in the subbasin moves toward the drain provided by the solution-enhanced permeability features that convey groundwater along the Havasu Downwarp to Havasu Springs. Although the total number of faults and fractures in the Coconino Plateau subbasin is very large, the number of solution-enhanced permeability features that function as major conduits for groundwater movement in the subbasin is relatively small. This condition can be observed along the south wall of Grand Canyon, where the distance between faults and fractures of all sizes is small, but the distance is large between solution-enhanced faults and fractures that yield or have in the past yielded substantial quantities of water from the Redwall-Muav aquifer.

Principal structural features incorporated into the model include the Bright Angel, Redlands, Red Horse, Hermit, and Vishnu faults, the Williams fault zone, the Havasu downwarp, and the Markham Dam fracture zone. The Markham Dam fracture zone is an 80-square-mile area of intense structural deformation where intersecting sets of extensional faults are readily visible at land surface. The Markham Dam fracture zone is characterized by intersecting grabens and sinkholes. The Markham Dam fracture zone and the Havasu Downwarp are the principal pathway for groundwater flow to Havasu Springs. The approximate center of the Markham Dam fracture zone is about 15 miles west from Valle.

Near the South Rim of Grand Canyon the Eremita Monocline, the Grandview-Phantom Monocline, and other structural features cause beds to dip locally and are associated with near-rim fractures. The bedding dip and offsets and associated local fracture systems near the South Rim result in small areas where local recharge is concentrated along fractures and bedding planes, and discharges at small springs and seeps. Sources of recharge for the small springs and seeps are believed to be the small, local drainage basins at the canyon rim; these small springs and seeps are considered to be poorly connected or not connected hydraulically to the large-scale groundwater movement in the regional Redwall-Muav aquifer.

Many faults have been mapped in the south part of the subbasin. However, based on analysis of aerial photographs and satellite images, except for the Williams fault zone, these faults are not located near areas of principal concern for the hydrogeologic investigation and do not appear to be intimately connected hydraulically to permeable features that supply water to the three principal springs along the South Rim. Therefore, most of the southern subbasin is modeled as non-fractured matrix rock and represents primarily the large capacity for groundwater storage in the Redwall-Muav aquifer in the region. The storage capacity dilutes the effects of short-term climatic cycles. The storage capacity also influences the rate at which short-term hydrologic impacts are projected to occur at the simulated springs. However, for long-range projections, aquifer storage does not influence the magnitude of projected hydrologic impact to springs. The Williams fault zone and Markham Dam fracture zone were included in the model based on structural analyses; inclusion was necessary for steady-state calibration.

Extensive geologic mapping and hydrologic analysis of the Coconino Plateau and Grand Canyon region (Billingsley and others 1983; Billingsley and Huntoon 1983; Harshbarger & Associates 1973; Huntoon 1982, 1994b, and 1995; Huntoon and Billingsley 1981; Huntoon and others 1996; Metzger 1961; Montgomery & Associates 1985; Moore, Wilson, and O'Haire 1960; Shoemaker and others 1978) constrain the location and interconnection of structural features that influence groundwater flow in the subbasin and provide little opportunity for radical re-interpretation of these principal features of the flow system.

### Groundwater Recharge

On the Coconino Plateau, groundwater recharge occurs chiefly from infiltration of precipitation and ephemeral streamflow. In addition, recharge of relatively small amounts of treated wastewater and, perhaps, untreated septic waste occurs near Tusayan and Grand Canyon Village. Average precipitation measured at Grand Canyon Village during the period from 1941 through 1972 was about 14.5 inches per year (Sellers and Hill 1974). Climatic records from the National Oceanic and Atmospheric Administration indicate that average precipitation during the period from 1931 through 1996 at Grand Canyon Village was 15.28 inches per year.

Most of the precipitation is lost via evaporation, transpiration, and surface water runoff. The remaining fraction infiltrates through permeable surface deposits and volcanic rocks, and through fractures and solution openings in the Kaibab Formation to recharge perched or regional aquifers. Metzger (1961) calculated average annual recharge to the principal aquifer to be about 0.3 inch per year, or about 2% of the average annual precipitation at Grand Canyon Village. This recharge rate is equal to about 10 gpm per square mile. The average annual recharge rate near the South Rim is likely to be larger than the average recharge rate for other parts of the subbasin due to higher altitude of land surface and larger amounts of precipitation at the South Rim than elsewhere in the subbasin. The average recharge rate of 10 gpm per square mile indicates that groundwater drainage areas for the seeps and small springs along the South Rim would range from a fraction of a square mile to a few square miles.

### Seeps and Small Springs Along South Rim of Grand Canyon

Faults and fracture systems that are not connected or are poorly connected to the regional groundwater flow system primarily provide additional aquifer storage. At many locations where these types of structural features intersect the south wall of Grand Canyon, small quantities of groundwater discharge at seeps and small springs. Seeps and small springs that issue from the Redwall-Muav aquifer are listed in Table 3.3 and include Miner's, O'Neill, Cottonwood, Cottonwood West, Grapevine, Boulder, Lonetree, Horn, Salt Creek, Monument, Boucher Creek, Boucher Spring, Elves Main and Joint, Matkatamiba, and Olo Springs. Figure 3.1 shows the general location of these springs. The seasonal nature and unsteady base flow of many of these seeps and small springs, as compared with the fairly steady base flow of Indian Garden, Hermit, and Havasu Springs, support the conclusion that discharge from these seeps and small springs results chiefly or solely from local near-rim recharge.

Several other springs with substantial discharge, most notably Warm, Diamond, Upper Diamond, and East Diamond Springs, issue from the Redwall- Muav aquifer along the South Rim of Grand Canyon (Figure 3.1). However, these springs are separated from the Coconino Plateau groundwater subbasin by the Aubrey

**Table 3.3 Source Rock and Altitude of Selected Springs Along South Rim of Grand Canyon**

| Spring Name[1] | Source Rock for Spring[2] | Spring Altitude[3] |
|---|---|---|
| Miner's (Page) | base of undifferentiated Cambrian rocks | 4,375 |
| O'Neill | lower Muav Limestone | 4,154 |
| Cottonwood | base of undifferentiated Cambrian rocks | 4,276 |
| Unnamed 1 (Cottonwood West) | base of undifferentiated Cambrian rocks | 4,650 |
| Unnamed 2 (Cottonwood East) | Bright Angel Shale | 3,640 |
| Grapevine | base of undifferentiated Cambrian rocks | 4,646 |
| Boulder | base of undifferentiated Cambrian rocks | — |
| Lonetree | middle and upper Muav Limestone | 4,025 |
| Sam Magee | upper Bright Angel Shale | 3,975 |
| Pipe | Bright Angel/Tapeats contact | 3,735 |
| Burro | Bright Angel Shale | 3,750 |
| Indian Garden | base of Muav Limestone | 3,892[4] |
| Horn | undifferentiated Cambrian rocks | 3,519 |
| Salt Creek | undifferentiated Cambrian rocks | 4,225 |
| Cedar | Bright Angel/Tapeats contact | 3,337 |
| Monument | undifferentiated Cambrian rocks | 3,940 |
| Hermit | basal Redwall Limestone | 4,075 |
| Hawaii[5] | lower Muav Limestone | 3,440 |
| Boucher Spring | Muav Limestone | 3,517 |
| Boucher Creek | undifferentiated Cambrian rocks & upper Muav | 3,455 |
| Elves Main | Muav Limestone | 3,023 |
| Elves Joint | Muav Limestone | 2,939 |
| Olo | basal Redwall Limestone to undifferentiated Cambrian rocks | 3,014 |
| Matkatamiba | basal Redwall Limestone to undifferentiated Cambrian rocks | 2,575 |

1. Springs are generally listed in down stream order with respect to the Colorado River. Name in ( ) was used by Fitzgerald (1996).
2. Source rock at uppermost orifice of discharge for the spring. Identified during helicopter-based survey conducted on January 31, 1998. Closer field inspection should be conducted to confirm that strata identified during the helicopter survey as undifferentiated Cambrian rocks do not include the Temple Butte Formation of Devonian age.
3. Based on GPS data obtained during helicopter-based survey conducted on January 31, 1998. Altitude and location are generally for uppermost spring, where a spring issues from more than one orifice.
4. Data for Two Trees orifice of Indian Garden Spring.
5. Hawaii Spring is a lower orifice in the Hermit Spring orifice system.

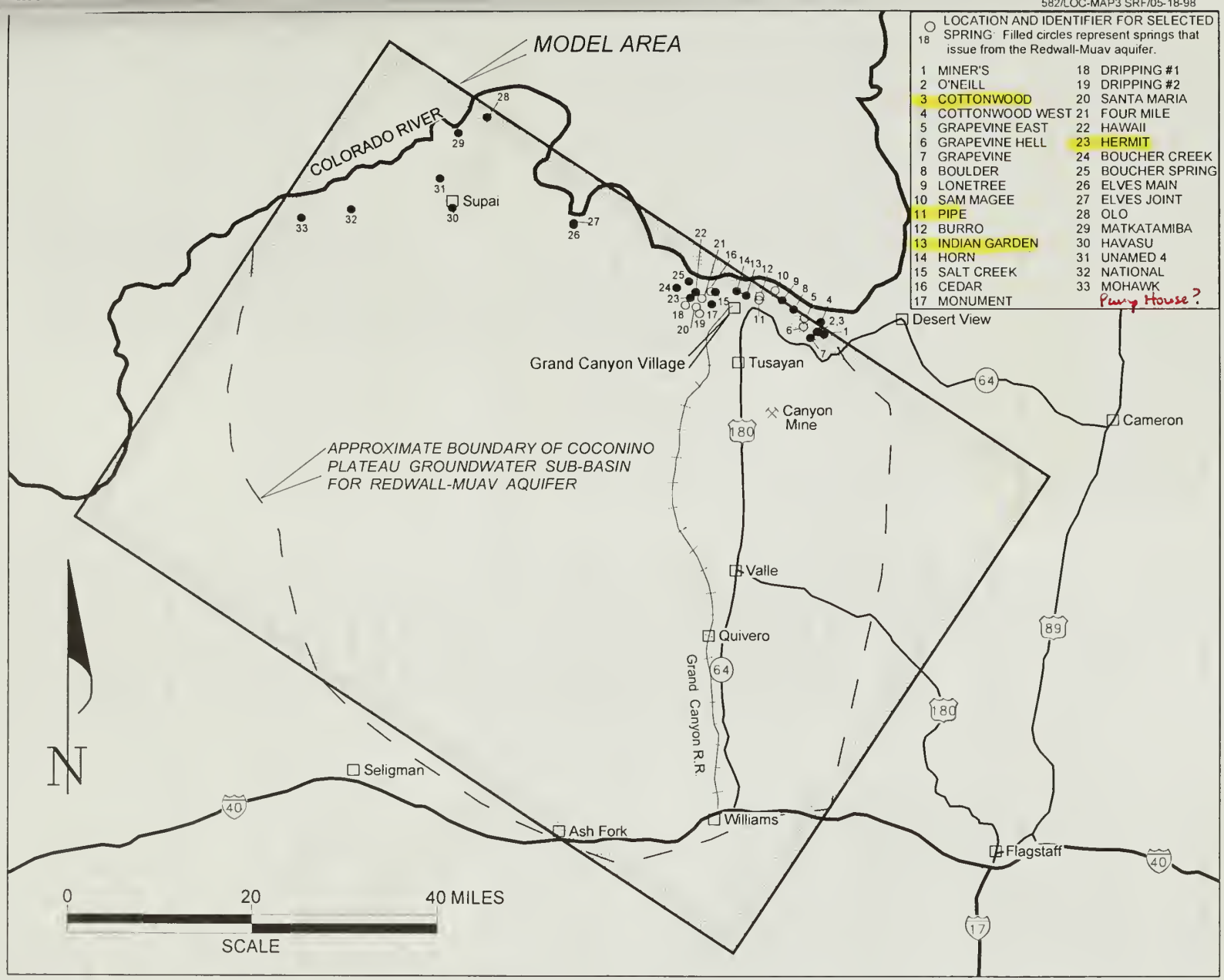



Figure 3.1 Location of Seeps and Small Springs Along the South Rim of Grand Canyon

and Toroweap fault systems and are distant from existing and proposed pumping centers on the Coconino Plateau.

In a desert environment, like that found throughout lower elevations of GCNP, water is a rare and important resource. While water in the Colorado River is always plentiful as it runs through Grand Canyon, some species of plants and animals rely on water from small seeps and springs scattered throughout the desert terrain distant from the Colorado River.

While birds, bats, and larger mammals have the mobility to seek out water from various sources, smaller mammals, amphibians, and reptiles are more dependent on local water sources such as seeps and springs. Insects are often associated with seeps and springs, providing a food base for reptiles, bats, and birds. Table 3.4 lists some of the more commonly known species found in Grand Canyon that rely on seeps and springs and the extent that they are dependent on these seeps and springs.

**Table 3.4 Representative List of Species within Grand Canyon that use Seeps and Springs**

| Species (common name) | Scientific Name | Dependence on Seeps and Springs |
|---|---|---|
| Rock Squirrel | *Spermophilus spilosoma* | locally dependent |
| White-tailed antelope squirrel | *Ammospermophilus leucurus* | locally dependent |
| Cliff chipmunk | *Eutamias dorsalis* | locally dependent |
| Long-tailed pocket mouse | *Perognathus formosus* | locally dependent |
| Rock pocket mouse | *P. intermedius* | locally dependent |
| Canyon mouse | *Peromyscus critinus* | locally dependent |
| White-throated woodrat | *Neotoma albigula* | locally dependent |
| Desert woodrat | *N. lepida* | locally dependent |
| Racoon | *Procyon lotor* | regional use |
| Ringtail | *Bassariscus astutus* | regional use |
| Spotted skunk | *Spilogale gracilis* | regional use |
| Coyote | *Canis latrans* | regional use |
| Gray fox | *Urocyon cinereoargenteus* | regional use |
| Mountain Lion | *Felis concolor* | regional use |
| Bobcat | *Lynx rufus* | regional use |
| Desert bighorn sheep | *Ovis canadensis* | regional use |
| Rocky Mountain toad | *Bufo woodhousei* | locally dependent |
| Red-spotted toad | *B. punctatus* | locally dependent |
| Canyon treefrog | *Hyla arenicolor* | locally dependent |
| Banded gecko | *Coleonyx variegatus* | locally dependent |
| Yellow-backed spiny lizard | *Sceloporus magister* | locally dependent |
| Side-blotched lizard | *Uta stansburiana* | locally dependent |
| Tree lizard | *Urosaurus ornatus* | locally dependent |
| Western whiptail | *Cnemidophorus tigris* | locally dependent |
| Ringneck snake | *Diadophis punctatus* | locally dependent |
| Striped whipsnake | *Masticophis taeniatus* | locally dependent |
| Sonoran gopher snake | *Pituophis melanoleucus* | locally dependent |
| California kingsnake | *Lampropeltis getulus* | locally dependent |
| Long-nosed snake | *Rhinocheilus lecontei* | locally dependent |
| Sonora lyre snake | *Trimorphodon biscutatus* | locally dependent |
| Night snake | *Hypsiglena torquata* | locally dependent |
| Black-tailed rattlesnake | *Crotalus molossus* | locally dependent |
| Grand Canyon rattlesnake | *C. viridis abyssus* | locally dependent |

Species that are locally dependent on a particular seep or spring are at the greatest risk to fluctuations in spring discharge. These species would die if the water source that they are dependent on was eliminated. While this would affect individuals of a species, it would not affect the viability of the species within Grand Canyon. No federally listed species are known to inhabit the seeps and small springs studied in this EIS; however, they may use the seeps and small springs on an incidental basis. Surveys for the Kanab ambersnail have been completed at several seeps and springs along the South Rim. A subspecies very similar to the Kanab ambersnail has been found at Indian Garden. Although currently identified as a different subspecies from the Kanab ambersnail, genetic work is underway to determine if this subspecies could be the same. (R.V. Ward, personal communication, June 16, 1998).

Bats and birds may use seeps and springs in Grand Canyon for water and foraging sites. However, the small size of most of the springs and associated vegetation limits the usefulness of these areas to bats and birds. Unless a spring has associated caves and pooled water, bats are unlikely to use the area for roosting or foraging (personal communication Charles Drost April 15, 1998). Likewise, most spring areas are not large enough to support more than one breeding pair of birds, and hence are not critical habitat areas for birds (personal communication, John Spence, April 15, 1998).

Vegetation associated with seeps and springs, while not abundant in Grand Canyon, is not restricted to this habitat. Table 3.5 lists a representative cross section of vegetation species commonly found in association with seeps and springs in Grand Canyon. These species are also present in side canyons with water, fluvial marshes along the Colorado River, and upland areas near the Colorado River.

**Table 3.5 Common Vegetation species associated with seeps and springs in Grand Canyon (from Spence, 1993)**

| Species (common name) | Scientific Name |
|---|---|
| Scarlet monkeyflower | *Mimulus cardinalis* |
| Saw grass | *Cladium californicum* |
| Bushy beardgrass | *Andropogon glomeratus* |
| Scatchgrass | *Muhlenbergia asperifolia* |
| Muhly | *M. thurberi* |
| Maidenhair fern | *Adiantum capillus-veneris* |
| Giant helleborine | *Epipactus gigantea* |
| Catclaw acacia | *Acacia greggii* |
| Cardinal flower | *Lobelia cardinalis* |
| Longleaf brickellbush | *Brickellia longifolia* |

### Water Transportation

No additional information is added.

## Socioeconomic Environment

Many of the comment letters received on the draft EIS focused on the economic modeling assumptions, analysis, and impact projections. As a result of these comments, the economic analysis was carefully reviewed and appropriate changes in the assumptions and baseline data were made. These changes are discussed in chapter 4.

### Grand Canyon/Tusayan Area

Lodging performance for Tusayan lodging properties was re-evaluated since release of the draft EIS. Based on this re-evaluation, the supplement will continue to use 72% as the average occupancy rate for Tusayan properties. Additional information regarding lodging performance in Tusayan is provided in the revised economic report in the Appendix.

Between publication of the draft EIS and the supplement, the Grand hotel and Canyon Star restaurant received zoning approval from the Coconino County Board of Supervisors for 160 lodging rooms. The first phase, including 120 rooms, is now under construction and is expected to open in summer 1998. The second phase, including 40 rooms is planned, but not yet constructed.

### Other Surrounding Communities

No additional information is added.

### Surrounding American Indian Tribes

In 1997, the Hualapai Tribe completed the Hualapai Lodge in Peach Springs, which includes 60 lodging rooms. Annual occupancy data is not available for this lodge because it has not been in operation for a full

year (Everett Manakaja, personal communication June 1, 1998). The Hopi Tribe have the Hopi Cultural Center in Second Mesa, which has 32 lodging rooms. This facility has annual occupancy rates averaging about 50% (Luan Dyer, personal communication June 1, 1998).

### Housing
No additional information is added.

### Employment Opportunities
No additional information is added.

### Crime Rates
No additional information is added.

### Community Infrastructure
No additional information is added.

## Visitor Experience In and Around Grand Canyon

### Grand Canyon Experience
No additional information is added.

### Visual Quality
No additional information is added.

### Air Quality
No additional information is added.

### Light Pollution
No additional information is added.

### Noise
No additional information is added.

### Grand Canyon National Park General Management Plan
No additional information is added.

### Grand Canyon Visitation
No additional information is added.

## Transportation
No additional information is added.

## Development Plan Assurances
On October 1988, the Arizona Legislature enacted a statute allowing development agreements between local governments (municipalities and counties) and private developers. Development agreements are voluntary contractual agreements that serve three major purposes. First, they provide assurances to developers by freezing applicable regulations. Second, they assist or enable local governments to secure infrastructure and other development amenities. In return for providing developers with security, local governments are in a better positions to request concessions from the developers. Finally, they reinforce local planning efforts. Because development agreements must be consistent with existing planning guides, they facilitate implementation of local plans. In addition, the agreement may specify the timing and phasing of a development, thereby allowing the local government to effectively guide development while implementing goals (Betts 1989).

Development agreements may specify allowable land use, density and intensity of development, conditions for financing or providing infrastructure, protection of sensitive lands, dedication of land for public service, or other matters related to development of the property. Development agreements must be recorded with the county and may be canceled with mutual consent from both parties (*Ibid.*).

## Cultural Resources

### Archaeological Sites
No additional information is added.

### American Indian Traditional Cultural Properties and Resources
Havasupai

The cultural significance the Havasupai attach to the water of Grand Canyon, especially Havasu and other springs, is deep and abiding. They note that "water circulating within the ground of the Coconino Plateau is the life-blood of the earth and the Havasupai. The water circulates in a pattern of equilibrium, a pattern of balance, which is supported by, accepted into, and is an integral part of the Havasupai Way as taught by Havasupai religious leaders and elders". Additionally, "[T]he springs, the land, and the water flowing

underground are sacred to us. Taking the water from the ground which flows to our sacred springs is sucking the life-blood of the Havasupai" (Havasupai Comment Letter, pg.5 1997).

### Hopi

The Hopi attach significant cultural importance to Blue Springs, near the Lower Basin private inholding, in part because of its proximity to the *Sipapuni*, or the Place of Emergence.

### Hualapai

No additional information is added.

### Navajo

No additional information is added.

### Zuni

No additional information is added.

## Biological Resources

### Vegetation

Please refer to Grand Canyon water resources section of this chapter for information on vegetation associated with small springs and seeps on the South Rim of Grand Canyon.

### Wildlife

Please refer to Grand Canyon water resources section of this chapter for information on wildlife associated with small springs and seeps on the South Rim of Grand Canyon.

### Threatened, Endangered, and Sensitive Species

No additional information is added.

## Forest Service Management

### Public Recreational Opportunities

No additional information is added.

### Fire Management Programs

No additional information is added.

### Private Inholdings

CFV controls 12 private inholdings within the Tusayan Ranger District of the Kaibab National Forest. Details regarding infrastructure development, proximity to the park, visibility from State Highway 64, and other market considerations of these 12 inholdings are given in Table 3.6. The private inholdings are grouped in order of preferred acquisition. Their relative priority for acquisition is based on the development potential of each private inholding and the presence of important natural or cultural resources. The development potential is determined by market conditions, existing Coconino County zoning ordinances and policies, and development limitations such as remoteness, availability of utilities, and access from paved roads.

Figure 2.4 shows the location of the 12 private inholdings. Lower Basin, Kotzin, and TenX have the greatest development potential and hence are top priority for acquisition.

| | Road Distance to Nearest GCNP Entrance Station | Visibility from Highway 64 | Other Market Considerations |
|---|---|---|---|
| | 8 miles | High visibility | • Increase in visitation to East Entrance of GCNP (17% annually) |
| | 2 miles | No visibility | • Within ⅛ mile from private property boundary of Tusayan |
| | 4 miles | No visibility | • Forested, desirable setting |
| | 17 miles | No visibility | |
| ) | 5 miles | No visibility | • Within 5 miles of Grandview entrance to GCNP |
| | 8 miles | No visibility | • Located along GC Railway alignment |
| | 10 miles | No visibility | • Located along GC Railway alignment |

**Table 3.6 Development Potential of Private Inholdings Involved in Land Exchange Alternatives**

| Priority for Acquisition | Private Inholding (size) | Infrastructure | | | Road Distance to Nearest GCNP Entrance Station | Visibility from Highway 64 | Other Market Considerations |
|---|---|---|---|---|---|---|---|
| | | Power (Distance to nearest power transmission line)[1] | Water | Access (Road Distance from State Highway 64 to parcel) | | | |
| Group 1 | Lower Basin (320 acres) | Requires on site power generation | Near Grandview-Phantom Monocline, which could provide favorable conditions for well development. Groundwater salinity may be elevated and require treatment. | Direct access to parcel from State Highway 64. | 8 miles | High visibility | • Increase in visitation to East Entrance of GCNP (17% annually) |
| | Kotzin (160 acres) | .25 miles | Near Vishnu fault system, which could provide favorable conditions for well development. | 2.25 miles by an unimproved road (FS2604) and an improved dirt road (FS 328) | 2 miles | No visibility | • Within ⅛ mile from private property boundary of Tusayan |
| | TenX (194 acres) | 2.25 miles | Located along a large structural feature, which could provide favorable conditions for well development. | 1.8 miles by improved gravel road (FS302) | 4 miles | No visibility | • Forested, desirable setting |
| Group 2 | Curley Wallace (150 acres) | 3 miles | Not located along principal mapped structural features Development of groundwater wells may be difficult, but should not be eliminated from consideration. | 3.5 miles by improved gravel road (FS320) | 17 miles | No visibility | |
| | Trash Dam (146 acres) | Requires on site power generation | Located along a synclinal structural feature, which could provide favorable conditions for well development. | 9 miles by improved dirt road (FS307) | 5 miles | No visibility | • Within 5 miles of Grandview entrance to GCNP |
| | Apex Siding (160 acres) | 3 miles | Located along a fault system, which could provide favorable conditions for well development. Water could be hauled to site by rail. | 9 5 miles by an improved/unimproved dirt road roads (FS 335 and FS 328) | 8 miles | No visibility | • Located along GC Railway alignment |
| | Anita (318 acres) | Requires on site power generation | Located along a fault system, which could provide favorable conditions for well development. Water could be hauled to site by rail. | 6 and 7 miles along improved dirt roads FS306 and FS347, respectively | 10 miles | No visibility | • Located along GC Railway alignment |

| Priority for Acquisition | Private Inholding (size) | Infrastructure | | | Road Distance to Nearest GCNP Entrance Station | Visibility from Highway 64 | Other Market Considerations |
|---|---|---|---|---|---|---|---|
| | | Power (Distance to nearest power transmission line)[1] | Water | Access (Road Distance from State Highway 64 to parcel) | | | |
| Group 3 | Babbitt Tank (120 acres) | 3.5 miles | Not located along principal mapped structural features. Development of groundwater wells may be difficult, but should not be eliminated from consideration. | 9 miles by improved gravel road (FS320) | 22 miles | No visibility | |
| | East Harbison (160 acres) | power transmission line traverses property boundary | Near Red Horse fault system and a synclinal structural feature, which could provide favorable conditions for well development. | Approximately 16 miles by improved dirt and gravel roads (FS305B, FS776, FS305, and FS320) | 29 miles | No visibility | |
| | Young (140 acres) | 2 miles | Not located along principal mapped structural features. Development of groundwater wells may be difficult, but should not be eliminated from consideration. Groundwater salinity may be elevated and require treatment. | Approximately 20 miles by improved gravel/dirt road (FS320) and an unimproved dirt road (241) | 34 miles | No visibility | |
| | Peterson (156 acres) | 2.5 miles | Not located along principal mapped structural features. Development of groundwater wells may be difficult, but should not be eliminated from consideration. Groundwater salinity may be elevated and require treatment. | Approximately 22 miles by improved gravel and dirt roads (FS320 and FS313) | 37 miles | No visibility | |
| | Willows (160 acres) | .25 miles | Not located along principal mapped structural features. Development of groundwater wells may be difficult, but should not be eliminated from consideration. Groundwater salinity may be elevated and require treatment. | Approximately 28 miles by improved dirt and gravel roads (FS305, FS776, ,FS305B, FS301, FS313, FS312, and FS320) | 40 miles | No visibility | |

1 Parcels more than 5 miles from the nearest power transmission line are assumed to require on-site power generation.

# Chapter 4 Environmental Consequences



## Introduction

This chapter presents the environmental consequences that are the basis for comparison of the alternatives presented in chapter 2. The chapter is organized by environmental component, such as surface and groundwater, socioeconomics, and cultural resources. This chapter focuses on the direct, indirect, and cumulative impacts of the three new alternatives. However, if methods of determining impacts have been revised since the draft EIS, a new description of the methods is presented and impacts for all eight alternatives are disclosed.

## Surface and Groundwater

### Water Supply

**Issue:** Development of private or NFS land near Tusayan would increase the demand for water.

#### Methods for Analyzing Impacts

No new methods are proposed.

#### Alternative D

##### Direct and Indirect Impacts

The GCIA indicated in a response to the draft EIS that additional water needs for this alternative would be met by obtaining groundwater from the three existing and one planned new well in Tusayan. This alternative would require 88.5 mgy of potable water to meet projected needs for the proposed level of development, including current water use in Tusayan (54.3 mgy). To supply water for the redevelopment of Tusayan, GCNP would supply/sell from the Roaring Springs system 12.5 mgy, or 14%, of the water required under this alternative, for NPS employee housing and the transportation staging area. Impacts associated with the water pipeline are discussed under water transportation. The three existing Tusayan wells and one additional new well proposed for Tusayan would provide 59.7 mgy of water (114 gpm of continuously pumped water), or 68%, of the additional water supply needed under this alternative. Drilling a fourth well in Tusayan would require a permit from the ADWR. Impacts to springs in Grand Canyon from operation of the four wells are further explored in Grand Canyon water resources. Water trucked from Williams would supply 18% (16.3 mgy) of the water required. Reclaimed water (nonpotable) obtained from the South Grand Canyon Sanitary District (SGCSD) would be used for toilets and irrigation. Wastewater discharge or reuse would require a National Pollution Discharge Elimination System (NPDES) Permit and an Aquifer Protection Permit (APP) from the Arizona Department of Environmental Quality (ADEQ). Table 4.1 presents the sources for potable water and estimated quantity of water supplied by each source.

##### Cumulative Impacts

Under Alternative D, cumulative impacts would result from additional water being supplied from a number of sources, including water purchased from GCNP, water from the wells in Tusayan, water purchases from Williams, and water development to serve potential visitor and residential facilities on the private inholdings controlled by CFV, if developed. As a result, demand for potable water is expected to increase throughout the region.

**Table 4.1 Estimated Potable Water Needs in Alternative D**

| Source | Water Quantity (mgy) | Percentage of Total Water Supply |
|---|---|---|
| **Groundwater** | | |
| Existing Well(s) | 25.5 | 29 |
| New Well(s) | 34.2[1] | 39 |
| **Water Supplied/Purchased from GCNP** | 12.5 | 14 |
| **Water Purchased from other Communities** | 16.3 | 18 |

1. The amount of water supplied by existing and new wells in Tusayan totals 59.7 mgy; pumping may be more evenly distributed between the wells than what is displayed in the table.

## Alternative F

### Direct and Indirect Impacts

Potable water for the proposed development (excluding the community uses) of an estimated 7 mgy would be drawn from the GCNP's water supply that originates within Grand Canyon at Roaring Springs. Water would be transport by an underground pipeline from the South Rim to a storage tank installed adjacent to the proposed transit center. The residential and community segments of this alternative would tie into the storage tank via underground pipelines for their water needs. If GCNP water is not available for community facilities, each facility would have to purchase water from Tusayan or other outside sources. Table 4.2 presents the sources for water and estimated quantity of water supplied by each source. Not a dependable supply!

**Table 4.2 Estimated Potable Water Needs in Alternative F**

| Source | Water Quantity (mgy) | Percentage of Total Water Supply |
|---|---|---|
| **Groundwater** | | |
| Existing Well(s) | 0 | 0 |
| New Well(s) | 0 | 0 |
| **Water Supplied/Purchased from GCNP** | 7 | 100 |
| **Water Purchased from other Communities** | 0 | 0 |
| **Water Harvested** | 0 | 0 |

GCNP could supply the necessary water for this alternative without affecting the park's other water obligations. Nonpotable water obtained from collection off the transit center parking lot (approximately 5 mgy) and from the SGCSD (approximately 17 mgy) would be used for toilet flushing and irrigation. Wastewater discharge or reuse would require NPDES and APP permits from ADEQ.

The amount of potable water consumed under this alternative includes 50 gallons per person per day for the residential area and 0.25 gallons per visitor per day for the transit center. Nonpotable water needs (excluding the community uses) for toilets and irrigation are estimated to be 22 mgy under Alternative F. Nonpotable water needs are based on 35 gallons per person per day for the residential area and 2 gallons per visitor per day for the transit center.

### Cumulative Impacts

Cumulative impacts in Alternative F would be the same as those described under Alternative D.

## Alternative G

### Direct and Indirect Impacts

Under this alternative, an estimated average of 2 mgy of potable water would be required for the transit center, and would be supplied from the GCNP Roaring Springs system. Another 48 mgy of potable water would be required for the CFV development. Groundwater from an existing well in Tusayan would be the primary source of water for the CFV development. In its current state, the existing well in Valle has the capacity to provide 47 mgy. An additional 1 mgy of water would be provided by 1) retrofitting the existing well in Valle to increase the capacity of this well, 2) providing additional on-site storage capacity to accommodate peak season demands, 3) purchasing water from the GCNP water system, and 4) purchasing water from outlying communities. Groundwater withdrawn from Valle would be capped at 48 mgy. Table 4.3 presents the sources and estimated quantity of potable water supplied by each source.

Water conservation measures would be implemented to reduce the amount of potable water demand, including water harvesting off the transit center parking lot and using reclaimed water for toilets and irrigation. Additional water conservation measures, implemented and funded by the Kaibab Institute, could further reduce potable water demand. Wastewater discharge or reuse would require NPDES and APP permits from ADEQ.

**Table 4.3 Estimated Potable Water Needs in Alternative G**

| Source | Water Quantity (mgy) | Percentage of Total Water Supply |
|---|---|---|
| **Groundwater** | | |
| Existing Well(s) | 48[1] | 96 |
| New Well(s) | 0 | 0 |
| **Water Supplied/Purchased from GCNP** | 2[2] | 4 |
| **Water Purchased from other Communities** | 0[3] | 0 |
| **Water Harvested** | 0 | 0 |

1. To meet the estimated potable water need of 48 mgy, the existing well would have to be retrofitted with a larger pump or supplemental water would be obtained from other sources. In its current state, this well can produce 47 mgy.
2. Water purchased from GCNP could be used as a supplemental source of water and for emergency situations.
3. Water purchased from other sources could be used as a supplemental source of water and for emergency situations.

The amount of potable water consumed under this alternative includes approximately 60.9 gallons per person per day in townhomes, 59.9 gallons per person per day in apartments, 55.6 gallons per person per day in dormitories, 55.9 gallons per person per day for lodging guests (Wright Water Engineers 1998), and 0.25 gallons per visitor per day for the transit center. Nonpotable water needs for toilets and irrigation are estimated to be 32 mgy under Alternative G. Nonpotable water needs are based on 15 gallons per person per day for the residential area and visitor lodging segment, and 2 gallons per visitor per day for the transit center.

### Cumulative Impacts

Additional development is expected to occur on the existing private land in Tusayan, on tribal land, on state land, and also in outlying communities, all of which would increase potable water demand. The cumulative impacts on water supply center around the ability of the region to provide sufficient water for its residents and visitors. Cumulatively, it can be expected that the search for water sources would increase in northern Arizona, both in Tusayan and in the outlying communities.

Each community in the area generally has its own developed water source(s) to supply water and, through sales, water to outlying rural subdivisions. At present, water demands in each community rarely substantially impact water supplies in neighboring communities within the Coconino Plateau groundwater subbasin. An exception is Tusayan, which supplements its water supply with purchases from Williams and GCNP. Drilling a third well in Tusayan has reduced Tusayan's dependence on water purchased from outlying areas, particularly Williams, potentially making more water available in Williams to accommodate growth in that community. A planned fourth well would further reduce Tusayan's dependence on outside water sources.

## Alternative H

### Direct and Indirect Impacts

Under this alternative, 44 mgy of potable water would be needed to support the proposed level of development in CFV, and 2 mgy of potable water would be needed for the transit center. Potable water would be supplied from Colorado River water hauled via railcar and piped underground to the development and from water harvested off impervious surfaces and treated to potable water standards. An existing groundwater well in Valle would be used only in emergency situations. Table 4.4 presents the sources and estimated quantity of potable water supplied by each source.

To minimize the use of potable water, maximum water conservation techniques would be implemented. These techniques would include xeriscaping, irrigating with reclaimed water, dual-plumbing residences and lodging units for reclaimed-water use, installing minimum water use fixtures (low-flow shower heads, toilets, and faucets) in all structures, and installing only showers in dormitories and in a minimum of 25% of the lodging

**Table 4.4 Estimated Potable Water Needs in Alternative H**

| Source | Water Quantity (mgy) | Percentage of Total Water Supply |
|---|---|---|
| **Groundwater** | | |
| Existing Well(s) | 0[1] | 0 |
| New Well(s) | 0 | 0 |
| **Water Supplied/Purchased from GCNP** | 2 | 1 |
| **Water Purchased from other Communities** | 0 | 0 |
| **Water Harvested** | 18[2] | 29 |
| **Colorado River Water** | 44[3] | 70 |

1. For emergency situations.
2. This is an estimate of what could be harvested off the parking lots and roof tops, and returned to potable use.
3. This amount would be reduced by the amount of water obtained and treated for potable use from water harvesting.

rooms. Water harvesting from the phase I and phase II parking areas and rooftop collection and reusing retreated wastewater for potable purposes would further reduce the amount of potable water needed from off-site sources for the development.

Sewage effluent generated by the development would be treated by a Solar Aquatics System, which uses no chemicals. Reclaimed wastewater may be discharged to natural or man-made ponds; reused for toilets in dual-plumbed facilities; used to irrigate landscaping, or retreated for potable use. Wastewater discharge or reuse would require NPDES and APP permits from ADEQ.

The amount of potable water consumed includes approximately 46.3 gallons per person per day in townhomes, 42.3 gallons per person per day in apartments, 40 gallons per person per day in dormitories, 41.3 gallons per person per day for lodging guests (Wright Water Engineers 1998), and 0.25 gallons per visitor per day for the transit center. Nonpotable water needs for toilets and irrigation are estimated to be 27 mgy under Alternative H. Nonpotable water needs are based on 7 gallons per person per day for the residential area, and visitor lodging segment, and 2 gallons per visitor per day for the transit center.

### Cumulative Impacts

Although Alternative H does not propose the use of groundwater for the CFV development, additional groundwater wells could be drilled to support potential development in the Grand Canyon/Tusayan area, in Valle, and on state and tribal land. Therefore, cumulative impacts under Alternative H would be similar to those described under Alternative G.

## Grand Canyon Water Resources

**Issue:** Additional groundwater pumping from the Redwall-Muav aquifer for new development could affect aquifer flow dynamics and could potentially affect spring flow and other water-related uses and values in GCNP and on tribal land. If a well is drilled on the Lower Basin private inholding, which is in the Black Mesa hydrologic basin, discharge from Blue Springs may be affected.

### Methods for Analyzing Impacts

Based on comments received on the draft EIS, some of the key methods and results presented in the draft EIS hydrogeologic report warrant further description. In addition, existing and planned use of groundwater from the regional aquifer system has changed substantially since the July 1996 hydrogeologic report by Montgomery & Associates was prepared. Therefore, supplemental hydrogeologic analysis was conducted for the Coconino Plateau groundwater subbasin. The number of existing and permitted water wells and the combined design pumping capacity for wells in the region have increased.

Goals during construction of the draft EIS model included: 1) maintain simplicity of the model within the limitations of the available data; and 2) minimize cell-by-cell application of input parameters where sparse hydrogeologic data are available.

The draft EIS groundwater flow model was constructed using MODFLOW. MODFLOW is a computer-based, numerical, finite-difference, groundwater flow modeling software package developed by the U.S. Geological Survey (USGS) (McDonald and Harbaugh 1988). MODFLOW was selected based on both suitability to simulate the groundwater flow system in the Redwall-Muav aquifer and on abundant documented uses in the public domain. MODFLOW was originally developed to model groundwater flow through porous media systems, such as sand and gravel aquifers. However, hydrogeologists have applied MODFLOW to several other types of systems, including groundwater flow in regional fractured rock systems (Huntoon 1994a, Mercer and Faust 1981). The use of MODFLOW for regional groundwater flow systems, including regional groundwater flow in fractured rock systems like the Redwall-Muav aquifer in the 5,270 square-mile Coconino Plateau groundwater subbasin, is appropriate and is generally preferred to other available models.

After the public review period for the draft EIS, a conference was held between several scientists, including experts in the fields of groundwater flow modeling and Grand Canyon hyrdrgeologists to review the draft EIS groundwater flow model. The participants reached consensus that the conceptual model and the use of MODFLOW were acceptable for modeling groundwater flow in the Redwall-Muav aquifer, with the understanding that no model can simulate a natural system perfectly and that there are drawbacks to using any model, including MODFLOW, for flow through either porous or fractured media. Because of the basis of the conceptual model and limitations to use of regional groundwater flow models, the numerical model was not designed to simulate impacts to seeps and small springs considered to be poorly connected or not connected to the regional groundwater movement in the Redwall-Muav aquifer system. Limitations and assumptions for applying MODFLOW are listed in the supplemental hydrogeologic report in the Appendix.

### Alternative A

#### Direct and Indirect Impacts

It is impossible to accurately predict the amount of groundwater necessary under this alternative because of the unspecified level of development, but it is possible that Alternative A could result in the highest collective amount of groundwater pumping.

Under Alternative A, additional development is expected on the existing private land in Tusayan, Valle, and potentially on three of the private inholdings controlled by CFV, increasing the demand for water from the Coconino Plateau subbasin. To meet this demand, it is possible that additional groundwater wells would be drilled in Tusayan, Valle, and on the private inholdings. Two pumping regimens were simulated based on assumed minimum and maximum simulated pumping rates. Pumping rates for the regimens are provided in Table 4.5.

In general, the minimum pumping regimen reflects the reported yield or minimum estimated needs from existing, planned, and potential future wells in the Coconino Plateau groundwater subbasin. The maximum pumping regimen reflects the reported pumping capacities or maximum estimated need from existing, planned, and potential future wells in the Coconino Plateau subbasin. A detailed description of the assumptions used to derive these pumping regimens is provided in the supplemental hydrogeologic report in the Appendix.

Table 4.6 shows the decrease in discharge anticipated at each of the springs modeled as a result of pumping under the minimum and maximum pumping regimens after 100 years for Alternative A. The rate of discharge from Havasu Springs would decrease between 1 and 2%, Indian Garden Springs would decrease between 8 and 32%, and Hermit Springs would decrease between 5 and 19%.

**Seeps and Small Springs**

Seeps and small springs that discharge groundwater from the Redwall-Muav aquifer along the South Rim are believed to be poorly connected or not connected hydraulically to the regional groundwater flow system. Therefore, the risk of impacts to the seeps and small springs from groundwater withdrawals in the regional groundwater flow system is believed to be small or none. However, if it is assumed that the seeps and small springs that issue from the Redwall-Muav aquifer are intimately connected hydraulically to the regional groundwater flow system, then it must also be assumed that a groundwater divide occurs between the

**Table 4.5 Minimum and Maximum Pumping Regimens Simulated in Alternative A**

| Pumping Center | 1989-1994 (gpm) | 1995-1997 (gpm) | 1998-2002 (gpm) | 2003-2088 (gpm) |
|---|---|---|---|---|
| **Minimum Pumping Regimen** | | | | |
| Tusayan | 24 | 49 | 114 | 114 |
| Valle | 0 | 33 | 33 | 133 |
| Tunnel Canyon | 0 | 0 | 50 | 50 |
| Hilltop Road | 0 | 0 | 0 | 0 |
| Williams | 0 | 0 | 45 | 45 |
| Canyon Mine | 1 | 1 | 1 | 1 |
| Kotzin Parcel | 0 | 0 | 0 | 0 |
| TenX Parcel | 0 | 0 | 0 | 0 |
| **Total** | **25** | **83** | **243** | **343** |
| **Maximum Pumping Regimen** | | | | |
| Tusayan | 80 | 160 | 285 | 285 |
| Valle | 0 | 130 | 130 | 230 |
| Tunnel Canyon | 0 | 0 | 50 | 50 |
| Hilltop Road | 0 | 0 | 0 | 50 |
| Williams | 0 | 0 | 45 | 45 |
| Canyon Mine | 1 | 1 | 1 | 5 |
| Kotzin Parcel | 0 | 0 | 0 | 100 |
| TenX Parcel | 0 | 0 | 0 | 100 |
| **Total** | **81** | **291** | **511** | **865** |

**Table 4.6 Projected Decrease in Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Groundwater Withdrawal in Alternative A**

| Spring | Simulated Steady-State Discharge Rate (gpm) | Projected Decrease in Discharge Minimum (percent) | Maximum (percent) |
|---|---|---|---|
| Havasu Springs | 28,997 | 1 | 2 |
| Indian Garden Springs | 294 | 8 | 32 |
| Hermit Springs | 310 | 5 | 19 |

regional system and each seep or small spring. Figure 4.1 illustrates the source of groundwater issuing from seeps and springs along the South Rim if there was no hydraulic connection versus if the springs and seeps were intimately connected to the regional aquifer.

Under Case A, the north boundary of the regional aquifer system is a groundwater barrier where the saturated thickness in the regional aquifer system thins to extinction against the underlying Bright Angel Shale. The source of water for seeps and small springs is local recharge in near-rim drainage areas, concentrated along local fracture systems and bedding planes, and discharges at the seeps and small springs. Drawdown from the pumping well does not affect discharge from seeps and small springs. Several seeps and small springs issue from strata overlying the saturated zone in the regional aquifer and can not be hydraulically connected to the regional aquifer system. A seep or small spring issues from the base of the Redwall-Muav aquifer, but is not hydraulically connected to the regional system of groundwater movement in the Redwall-Muav aquifer. This case is believed to be predominant at seeps and small springs along the South Rim.

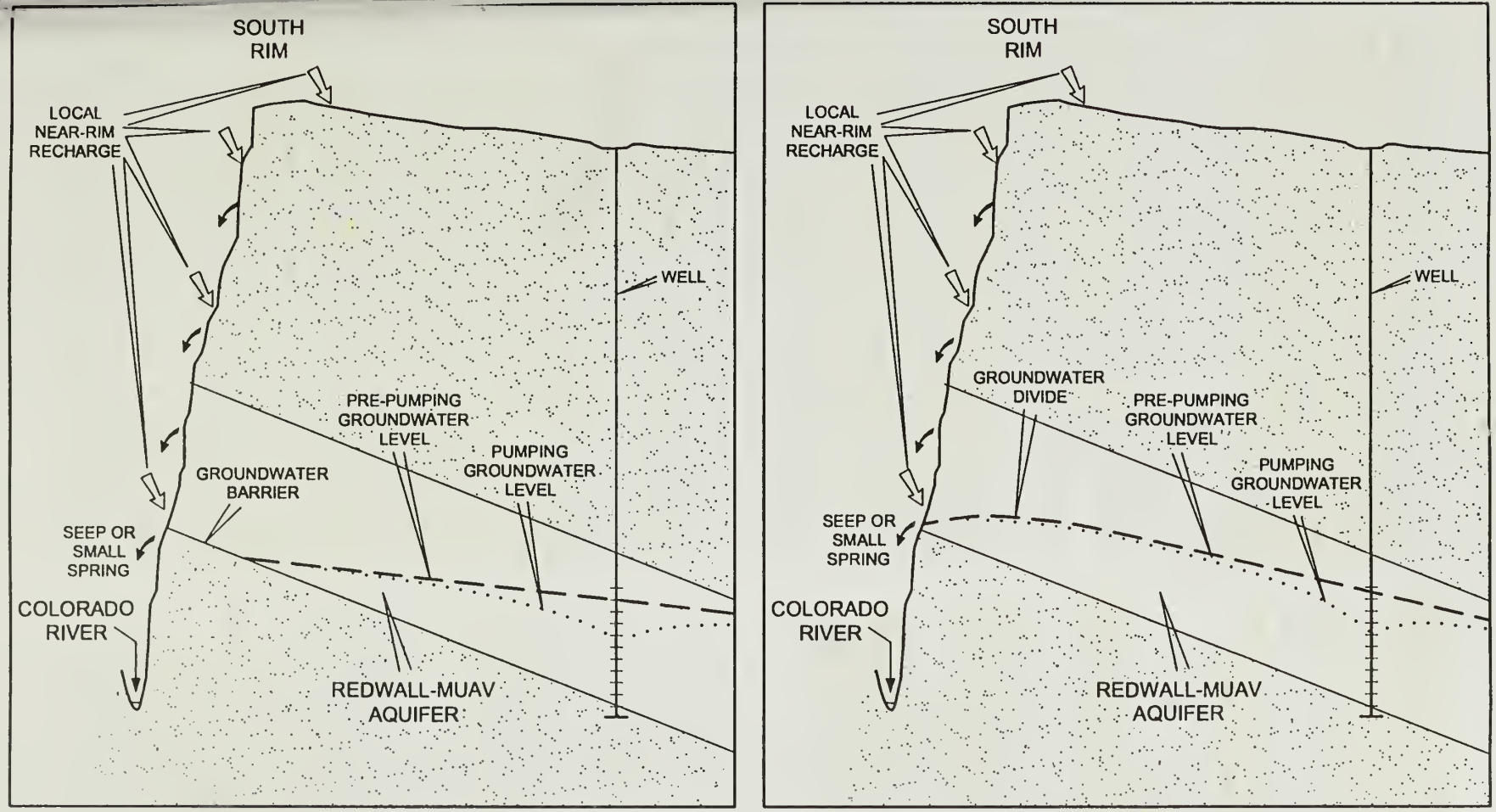

SOUTH RIM
LOCAL NEAR-RIM RECHARGE
WELL
PRE-PUMPING GROUNDWATER LEVEL
PUMPING GROUNDWATER LEVEL
GROUNDWATER BARRIER
SEEP OR SMALL SPRING
COLORADO RIVER
REDWALL-MUAV AQUIFER
CASE A. NO HYDRAULIC CONNECTION BETWEEN REGIONAL REDWALL-MUAV AQUIFER, AND SOUTH RIM SEEPS AND SMALL SPRINGS
SOUTH RIM
LOCAL NEAR-RIM RECHARGE
WELL
GROUNDWATER DIVIDE
PRE-PUMPING GROUNDWATER LEVEL
PUMPING GROUNDWATER LEVEL
SEEP OR SMALL SPRING
COLORADO RIVER
REDWALL-MUAV AQUIFER
CASE B. INTIMATE HYDRAULIC CONNECTION BETWEEN GROUNDWATER IN REGIONAL REDWALL-MUAV AQUIFER AND LOWERMOST SOUTH RIM SEEP OR SMALL SPRING ISSUING FROM THE AQUIFER

Figure 4.1 Conceptual Diagram for the Source of Groundwater Issuing from Seeps and Small Springs Along the South Rim of Grand Canyon

Under Case B, the source of water for seeps and small springs is local recharge in near-rim drainage areas and several of these seeps and small springs issue from strata overlying the regional aquifer system. In addition, however, the seep and small spring that issues from the principal saturated zone of the Redwall-Muav aquifer is also intimately connected hydraulically to the regional system of groundwater movement in the Redwall-Muav aquifer. A groundwater divide occurs between the seep and small spring and the pumping well, and pumping from the well draws down the groundwater level and decreases the hydraulic gradient toward this seep or small spring, thereby decreasing its discharge. In this case, the north boundary of the regional aquifer system is a groundwater divide. However, it should be emphasized that drawdown from the pumping well can not affect discharge from seeps and small springs that issue above the principal saturated zone of the Redwall-Muav aquifer. This case may occur at Hermit and Indian Garden Springs, but is not believed to be predominant at seeps and small springs along the South Rim.

It is believed that a groundwater divide is necessary because the direction of groundwater movement toward the seeps and small springs would be different than the direction of groundwater movement toward the principal point of discharge from the aquifer, Havasu Springs. Under these hypothetical conditions, groundwater level drawdown caused by pumping from the regional system could conceivably cause a lowering of the groundwater divide, a diminishment of the hydraulic gradient from the divide to the seep or spring, and, consequently, a hypothetical reduction in discharge from the seeps and small springs.

Under the minimum simulated pumping regimens for all of the alternatives, projected cumulative groundwater level drawdown near the South Rim and, therefore, the hypothetical risk of substantial hydrologic impacts are highest at seeps and small springs that issue from the Redwall-Muav aquifer east from Indian Garden Spring. These seeps and small springs include: Miner's, O'Neill, Cottonwood, Cottonwood West, Grapevine, Boulder, and Lonetree Springs. Figure 3.1 shows the general location of these seeps and small springs.

Under the maximum simulated pumping regimens for the non-land-exchange alternatives (Alternatives A, D, E, and F), simulated pumping centers at Tusayan and at the Kotzin and Ten-X private inholdings are projected to cause the largest groundwater level drawdown near the South Rim and, therefore, would pose the highest hypothetical risk to seeps and small springs in the subbasin that issue from the Redwall-Muav aquifer east from Hermit Spring. These seeps and small springs include Horn, Salt Creek, Monument, and Hawaii, in addition to those that are east from Indian Garden Spring.

The magnitude of impact to seeps and small springs is primarily a function of pumping rates and well locations. Cumulative impacts would be lowest under the minimum simulated pumping regimens, for Alternatives A, D, E, F, and H. Under the maximum simulated pumping regimens, cumulative impacts would be highest for Alternatives A, D, E, and F.

Another method to qualitatively assess the hydrologic impact to seeps and small springs is to assume that the projected decrease in discharge for Indian Garden and Hermit Springs would be similar to projected decrease in discharge from seeps and small springs that issue from the Redwall-Muav aquifer near these two larger springs. Again, the hypothetical condition of intimate hydraulic connection of the seeps and small springs with the regional groundwater flow system must be assumed. The percent decrease could be assumed to be smaller with increasing distance from the pumping centers and from Indian Garden and Hermit Springs. Based on these assumptions, the hypothetical risk of hydrologic impacts to seeps and small springs would be highest at Miner's, O'Neill, Cottonwood, Cottonwood West, Grapevine, Boulder, Lonetree, Horn, Salt Creek, and Monument. The hypothetical risk of hydrologic impacts would be lowest at Boucher, Elves Main and Joint, Olo, Matkatamiba, National, and Mohawk Springs, because of the relatively low matrix transmissivity of the aquifer and the large distance between pumping centers and the springs.

**Blue Springs**

Total discharge from Blue Springs is about 100,000 gpm from the Redwall-Muav aquifer along the Little Colorado River in the Black Mesa hydrologic basin.

The uppermost orifice of Blue Springs is about 15 miles northeast from the east hydrologic boundary of the Coconino Plateau groundwater subbasin. The north part of this boundary is best defined near the South Rim along the Grandview-Phantom monocline, where the Redwall-Muav carbonate sequence has been uplifted. Further south toward Highway 180, the aquifer occurs at lower altitudes along the east boundary of the Coconino Plateau groundwater subbasin because of structural features and regional dip. If groundwater level drawdown were large, a potential exists for the groundwater divide to migrate eastward and capture a small fraction of the groundwater that would ultimately have discharged at Blue Springs.

The Black Mesa hydrologic basin includes a very large area that extends east across northeast Arizona and into New Mexico, and south into the Flagstaff area. The cumulative discharge from Blue Springs (about 100,000 gpm) is more than three times as large as the discharge at Havasu Springs (about 29,000 gpm). In addition, discharge from Blue Springs is 100 times as large as the largest anticipated rate of groundwater withdrawal from existing, planned, and reasonably foreseeable future wells in the Coconino Plateau groundwater subbasin. Therefore, even if all of the existing, planned, and potential future withdrawals of groundwater from the Redwall-Muav aquifer would be derived solely from Blue Springs, the decrease in the total discharge from Blue Springs would be less than 1%.

Discharge from Blue Springs could also be affected if groundwater wells were drilled and pumped on the Lower Basin private inholding. Long-term pumping of water at Lower Basin would intercept groundwater that would have discharged at Blue Springs. Eventually this condition would result in a lower total rate of discharge from Blue Springs.

New water demands from growth in the outlying community of Flagstaff are not expected to affect water discharge at springs in Grand Canyon because Flagstaff derives its water from different groundwater subbasins and different aquifer systems. The primary municipal water source for Williams is a series of surface reservoirs; therefore, the city does not rely on groundwater from the Coconino Plateau groundwater subbasin for water supply. However, a new well east of Williams that was recently drilled intercepts the Redwall-Muav aquifer. This well could contribute up to 45 gpm of groundwater for the Williams water supply. The boundary of the Coconino Plateau groundwater subbasin lies close to Williams, and it is likely that a groundwater well drilled near Williams would withdraw groundwater that would have otherwise discharged from this subbasin.

### Alternative B

#### Direct and Indirect Impacts

After buildout, the proposed CFV development would pump 147 mgy (279.7 gpm) from five proposed wells in the Valle area. According to the groundwater study (Errol L. Montgomery & Associates 1998), the Valle wells would draw more water that would have discharged from Havasu Springs than from Hermit and Indian Garden springs because Havasu Springs are closer to the wells. However, because of the volume of water discharged from Havasu Springs, (29,000 gpm, compared to 300 gpm each from Hermit and Indian Garden springs), any reductions in flow from Havasu Springs would be a smaller fraction of the entire discharge of Havasu Springs.

Table 4.7 shows the decrease in discharge anticipated at each of the springs under this alternative. Continuous pumping at about 280 gpm from the five Valle wells over 100 years would decrease the rate of discharge from Havasu Springs by 0.8%, from Indian Garden Springs by 3%, and from Hermit Springs by 2%.

If allowed, the aquifer could be recharged by reinjection of treated effluent. Reinjection of treated effluent into the regional aquifer could attenuate impacts from groundwater withdrawal. The effectiveness of recharge to the regional aquifer would be a function of how much water is reinjected and the location of the reinjection wells.

#### Cumulative Impacts

Two pumping regimens were simulated based on an assumed minimum and maximum pumping rate to evaluate cumulative impacts. Pumping rates for the regimens are provided in Table 4.8.

**Table 4.7 Projected Decrease in Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Groundwater Withdrawal in Alternative B**

| Spring | Simulated Steady-State Discharge Rate (gpm) | Projected Decrease in Discharge (gpm) | (percent) | Adjusted Discharge Rate |
|---|---|---|---|---|
| Havasu Springs | 28,997 | 241 | 0.8 | 28,756 |
| Indian Garden Springs | 294 | 8 | 3.0 | 286 |
| Hermit Springs | 310 | 6 | 2.0 | 304 |

**Table 4.8 Minimum and Maximum Pumping Regimens Simulated in Alternative B**

| Pumping Center | 1989-1994 (gpm) | 1995-1997 (gpm) | 1998-2002 (gpm) | 2003-2088 (gpm) |
|---|---|---|---|---|
| **Minimum Pumping Regimen** | | | | |
| Tusayan | 24 | 49 | 114 | 114 |
| Valle | 0 | 33 | 291 | 391 |
| Tunnel Canyon | 0 | 0 | 50 | 50 |
| Hilltop Road | 0 | 0 | 0 | 0 |
| Williams | 0 | 0 | 45 | 45 |
| Canyon Mine | 1 | 1 | 1 | 1 |
| Kotzin Parcel | 0 | 0 | 0 | 0 |
| TenX Parcel | 0 | 0 | 0 | 0 |
| **Total** | **25** | **83** | **501** | **601** |
| **Maximum Pumping Regimen** | | | | |
| Tusayan | 80 | 160 | 285 | 285 |
| Valle | 0 | 130 | 321 | 421 |
| Tunnel Canyon | 0 | 0 | 50 | 50 |
| Hilltop Road | 0 | 0 | 0 | 50 |
| Williams | 0 | 0 | 45 | 45 |
| Canyon Mine | 1 | 1 | 1 | 5 |
| Kotzin Parcel | 0 | 0 | 0 | 0 |
| TenX Parcel | 0 | 0 | 0 | 0 |
| **Total** | **81** | **291** | **702** | **856** |

A detailed description of the assumptions used to derive these pumping regimens is provided in the supplemental hydrogeologic report in the Appendix.

Table 4.9 shows the decrease in discharge anticipated at each of the springs as a result of regional pumping under the minimum and maximum pumping regimens in 100 years under Alternative B. The rate of discharge from Havasu Springs would decrease by 2%, Indian Garden Springs would decrease between 11 and 20%, and Hermit Springs would decrease between 6 and 12%.

**Seeps and Small Springs**

Seeps and small springs that discharge groundwater from the Redwall-Muav aquifer along the South Rim are believed to be poorly connected or not connected hydraulically to the regional groundwater flow system. Therefore, the risk of impacts to the seeps and small springs from groundwater withdrawals in the regional

**Table 4.9 Projected Decrease in Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Cumulative Groundwater Withdrawal in Alternative B**

| Spring | Simulated Steady-State Discharge Rate (gpm) | Projected Decrease in Discharge Minimum (percent) | Maximum (percent) |
|---|---|---|---|
| Havasu Springs | 28,997 | 2 | 2 |
| Indian Garden Springs | 294 | 11 | 20 |
| Hermit Springs | 310 | 6 | 12 |

groundwater flow system is believed to be limited. However, if they are assumed to be intimately connected, cumulative impacts to springs and small seeps under the minimum simulated pumping regimens for all alternatives would be highest in Alternatives B and C.

### Alternative C

#### Direct and Indirect Impacts

The impacts on water resources from this proposal would be similar to, but slightly lower than, those discussed under Alternative B because the total water needs for Alternative C are slightly less. This alternative would also draw water from five proposed wells in the Valle area. After buildout, the proposed CFV development would pump 140 mgy (266.4 gpm) from five wells in the Valle area. Table 4.10 shows the projected decrease in discharge anticipated at each of the springs under Alternative C after 100 years, the rate of discharge from Havasu Springs would decrease by 0.8%, from Indian Garden Springs by 2.7%, and from Hermit Springs by 1.8%.

**Table 4.10 Projected Decrease in Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Groundwater Withdrawal in Alternative C**

| Spring | Simulated Steady-State Discharge Rate (gpm) | Projected Decrease in Discharge (gpm) | (percent) | Adjusted Discharge Rate |
|---|---|---|---|---|
| Havasu Springs | 28,997 | 229 | 0.8 | 28,768 |
| Indian Garden Springs | 294 | 8 | 2.7 | 286 |
| Hermit Springs | 310 | 6 | 1.8 | 304 |

#### Cumulative Impacts

The cumulative impacts under Alternative C are expected to be similar to those described under Alternative B.

### Alternative D

#### Direct and Indirect Impacts

Under Alternative D, all additional water demand from redevelopment would be met from groundwater withdrawal. Tusayan would pump a total of 59.7 mgy (114 gpm) by the year 2002. After 100 years of pumping at this rate, the rate of discharge at Havasu Springs would be reduced by 0.3%, Indian Garden Springs would be reduced by 6%, and Hermit Springs would be reduced by 4%. Table 4.11 shows the combined effects on discharge at the springs from the three existing wells in Tusayan and a proposed fourth well.

Under Alternative D, Tusayan proposes to receive an additional 7.87 mgy from GCNP. The GCNP pipeline is gravity fed from Roaring Springs to the Indian Gardens pumping station and has a capacity of approximately 700 gpm. When the pumps at Indian Gardens are not running, the excess water overflows into Garden and Pipe creeks. The amount of water required for this alternative is not expected to change the frequency of artificial surges of water caused by sudden shutdowns of the pumps at Indian Gardens.

**Table 4.11 Projected Decrease in Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Groundwater Withdrawal in Alternative D**

| Spring | Simulated Steady-State Discharge Rate (gpm) | Projected Decrease in Discharge (gpm) | (percent) | Adjusted Discharge Rate |
|---|---|---|---|---|
| Havasu Springs | 28,997 | 78 | 0.3 | 28,919 |
| Indian Garden Springs | 294 | 18 | 6.1 | 276 |
| Hermit Springs | 310 | 12 | 4.0 | 298 |

### Cumulative Impacts

The cumulative effects of Alternative D are similar to the direct and indirect impacts discussed under Alternative A because, in addition to the redevelopment of Tusayan, development is likely on several of the private inholdings controlled by CFV and on other outlying private, state, and tribal land. This additional development would likely require additional groundwater from the Coconino Plateau groundwater subbasin.

## Alternative E

### Direct and Indirect Impacts

Pumping of groundwater would not increase under this alternative. Rather, the proposed development would receive 7 mgy of potable water from GCNP and 22 mgy of nonpotable water from the SGCSD. The additional 7 mgy of potable water needed under Alternative E would be supplied from the Roaring Springs system. As discussed under Alternative D, the amount of water required for this alternative is not expected to change the frequency of artificial surges of water caused by sudden shutdowns of the pumps at Indian Gardens.

### Cumulative Impacts

The cumulative effects of Alternative E would be the same as the direct and indirect impacts discussed under Alternative A.

## Alternative F

### Direct and Indirect Impacts

Pumping of groundwater would not increase under this alternative. Rather, the proposed development would receive approximately 7 mgy of potable water from GCNP, an estimated 17 mgy of nonpotable water from the SGCSD, and an estimated 5 mgy from water harvesting off of the parking lot at the transit center.

As discussed under Alternative D, the amount of water required for this alternative is not expected to change the frequency of artificial surges of water caused by sudden shutdowns of the pumps at Indian Gardens.

### Cumulative Impacts

The cumulative effects of Alternative F would be the same as the direct and indirect impacts discussed under Alternative A.

## Alternative G

### Direct and Indirect Impacts

After buildout, the proposed development could potentially pump 48 mgy (91 gpm) of groundwater from Valle. According to the groundwater study (Errol L. Montgomery & Associates 1998), the Valle wells would draw more water from Havasu Springs than from Hermit and Indian Garden springs because Havasu Springs are closer to the wells. However, because of the large volume of water discharged from Havasu Springs, any reductions in flow from Havasu Springs would be a smaller fraction of the entire discharge of Havasu Springs.

Table 4.12 shows the decrease in discharge anticipated at each of the springs under this alternative. Continuous pumping of about 91 gpm from the Valle well over 100 years would decrease the rate of discharge from Havasu Springs by 0.3%, from Indian Garden Springs by 0.9%, and from Hermit Springs by 0.6%.

### Cumulative Impacts

Two pumping regimens were simulated based on a projected minimum and maximum pumping rate to evaluate cumulative impacts. Pumping rates for the regimens are provided in Table 4.13.

**Table 4.12 Projected Decrease in Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Groundwater Withdrawal in Alternative G**

| Spring | Simulated Steady-State Discharge Rate (gpm) | Projected Decrease in Discharge (gpm) | (percent) | Adjusted Discharge Rate |
|---|---|---|---|---|
| Havasu Springs | 28,997 | 78 | 0.3 | 28,919 |
| Indian Garden Springs | 294 | 3 | 0.9 | 291 |
| Hermit Springs | 310 | 2 | 0.6 | 308 |

**Table 4.13 Minimum and Maximum Pumping Regimens Simulated in Alternative G**

| Pumping Center | 1989-1994 (gpm) | 1995-1997 (gpm) | 1998-2002 (gpm) | 2003-2088 (gpm) |
|---|---|---|---|---|
| **Minimum Pumping Regimen** | | | | |
| Tusayan | 24 | 49 | 114 | 114 |
| Valle | 0 | 33 | 102 | 202 |
| Tunnel Canyon | 0 | 0 | 50 | 50 |
| Hilltop Road | 0 | 0 | 0 | 0 |
| Williams | 0 | 0 | 45 | 45 |
| Canyon Mine | 1 | 1 | 1 | 1 |
| Kotzin Parcel | 0 | 0 | 0 | 0 |
| TenX Parcel | 0 | 0 | 0 | 0 |
| **Total** | **25** | **83** | **312** | **412** |
| **Maximum Pumping Regimen** | | | | |
| Tusayan | 80 | 160 | 285 | 285 |
| Valle | 0 | 130 | 132 | 232 |
| Tunnel Canyon | 0 | 0 | 50 | 50 |
| Hilltop Road | 0 | 0 | 0 | 50 |
| Williams | 0 | 0 | 45 | 45 |
| Canyon Mine | 1 | 1 | 1 | 5 |
| Kotzin Parcel | 0 | 0 | 0 | 0 |
| TenX Parcel | 0 | 0 | 0 | 0 |
| **Total** | **81** | **291** | **513** | **667** |

A detailed description of the assumptions used to derive these pumping regimens is provided in the supplemental hydrogeologic report in the Appendix.

Table 4.14 shows the decrease in discharge anticipated at each of the springs as a result of pumping under the minimum and maximum pumping regimens in 100 years under Alternative G. The rate of discharge from Havasu Springs would decrease between 1 and 2%, Indian Garden Springs would decrease between 9 and 18%, and Hermit Springs would decrease between 5 and 11%.

**Seeps and Small Springs**

If seeps and small springs that discharge from the Redwall-Muav aquifer were assumed to be intimately connected to the regional groundwater flow system, cumulative impacts under the minimum pumping regimen for Alternative G would be less than those projected for Alternatives B and C, but greater than those projected for Alternatives A, D, E, F, and H under the minimum pumping regimens for all alternatives. Under the maximum pumping regimen for all alternatives, cumulative impacts to the seeps and small springs would be lowest for Alternatives G and H.

**Table 4.14 Projected Decrease in Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Cumulative Groundwater Withdrawal in Alternative G**

| Spring | Simulated Steady-State Discharge Rate (gpm) | Projected Decrease in Discharge Minimum (percent) | Maximum (percent) |
|---|---|---|---|
| Havasu Springs | 28,997 | 1 | 2 |
| Indian Garden Springs | 294 | 9 | 18 |
| Hermit Springs | 310 | 5 | 11 |

### Alternative H

#### Direct and Indirect Impacts

Pumping of groundwater would not increase under this alternative because the proposed development would receive approximately 44 mgy of potable water from the Colorado River, and an estimated 18 mgy from water harvesting off of the parking lots and rooftop collection and treated to potable water standards. Groundwater from an existing well in Valle would only be pumped in emergency situations.

#### Cumulative Impacts

Two pumping regimens were simulated based on a projected minimum and maximum pumping rate to evaluate cumulative impacts. Pumping rates for the regimens are provided in Table 4.15.

**Table 4.15 Minimum and Maximum Pumping Regimens Simulated in Alternative H**

| Pumping Center | 1989-1994 (gpm) | 1995-1997 (gpm) | 1998-2002 (gpm) | 2003-2088 (gpm) |
|---|---|---|---|---|
| **Minimum Pumping Regimen** | | | | |
| Tusayan | 24 | 49 | 114 | 114 |
| Valle | 0 | 33 | 33 | 133 |
| Tunnel Canyon | 0 | 0 | 50 | 50 |
| Hilltop Road | 0 | 0 | 0 | 0 |
| Williams | 0 | 0 | 45 | 45 |
| Canyon Mine | 1 | 1 | 1 | 1 |
| Kotzin Parcel | 0 | 0 | 0 | 0 |
| TenX Parcel | 0 | 0 | 0 | 0 |
| **Total** | **25** | **83** | **243** | **343** |
| **Maximum Pumping Regimen** | | | | |
| Tusayan | 80 | 160 | 285 | 285 |
| Valle | 0 | 130 | 130 | 230 |
| Tunnel Canyon | 0 | 0 | 50 | 50 |
| Hilltop Road | 0 | 0 | 0 | 50 |
| Williams | 0 | 0 | 45 | 45 |
| Canyon Mine | 1 | 1 | 1 | 5 |
| Kotzin Parcel | 0 | 0 | 0 | 0 |
| TenX Parcel | 0 | 0 | 0 | 0 |
| **Total** | **81** | **291** | **511** | **665** |

A detailed description of the assumptions used to derive these pumping regimens is provided in the supplemental hydrogeologic report in the Appendix.

Table 4.16 shows the decrease in discharge anticipated at each of the springs as a result of pumping under the minimum and maximum pumping regimens in 100

years under Alternative H. The rate of discharge from Havasu Springs would decrease between 1 to 2%, Indian Garden Springs would decrease between 8 to 18%, and Hermit Springs would decrease between 5 to 11%.

**Table 4.16 Adjusted Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Cumulative Groundwater Withdrawal in Alternative H**

| Spring | Simulated Steady-State Discharge Rate (gpm) | Decrease in Discharge (percent) Minimum | Maximum |
|---|---|---|---|
| Havasu Springs | 28,997 | 1 | 2 |
| Indian Garden Springs | 294 | 8 | 18 |
| Hermit Springs | 310 | 5 | 11 |

**Seeps and Small Springs**

If seeps and small springs that discharge from the Redwall-Muav aquifer were assumed to be intimately connected, cumulative impacts would be lowest under the minimum and maximum pumping regimens for Alternative H.

## Water Transportation

**Issue:** Increased hauling of water from surrounding areas could increase vehicle emissions and resultant air pollution and could decrease public safety on roadways. Construction of pipelines to transport water from distant sources could affect natural and cultural resources.

What about removal of transcanyon pipelines?

### Methods for Analysis

No new methods are proposed.

### Alternative F

#### Direct and Indirect Impacts

Impacts from water transportation would be expected from increased water needs under this alternative. Water to meet increased demand would be supplied from the GCNP water system from Roaring Springs on the north side of Grand Canyon. The additional water provided by the GCNP would be delivered to the transit center, the proposed federal housing complex, and potentially, the proposed community facilities by a five-mile pipeline constructed within the right-of-way designated for the mass transit system. Construction of a pipeline system has the potential to impact natural and cultural resources; however, the use of the same corridor for multiple purposes would have fewer impacts to natural and cultural sources than the construction of separate corridors for individual purposes. Additional cultural resources and threatened, endangered, and sensitive plant species would be conducted along the proposed corridor prior to construction. Adjustments in the location of the corridor could reduce or avoid impacts to natural and cultural resources.

If GCNP water is not available for community facilities, each facility would have to obtain water from Tusayan or other outside sources. This could result in additional traffic from transporting water on State Highway 64 if water is purchased from outlying areas.

#### Cumulative Impacts

Under Alternative F, three of the private inholdings controlled by CFV could potentially be developed. While the level of development of these inholdings is unknown, it is likely that additional demand for water would be required. additionally, redevelopment of Tusayan and development of outlying private, tribal land, and state trust land would increase in the amount of water required to service these developments. Water for these developments could either be trucked in from existing sources such as Grand Canyon or Williams, or be provided from existing or new wells and then trucked or piped to areas where it would be used. Water for development on the inholdings could be provided from construction of new on-site wells.

In 1995, 28.8 million gallons of water were hauled by an estimated 4,800 truck loads to Tusayan from Williams and GCNP. This number of truck loads is about 0.3% of the average daily vehicle traffic generated on State Highway 64 between Valle and Tusayan.

Because the future volume and source of needed water are unknown, the increase in tanker-truck traffic cannot be estimated. However, truck traffic would be expected to increase if on-site wells or water pipelines are not constructed to each of the developments. If water hauling traffic increases, corresponding impacts to air quality, road conditions, traffic, and highway safety would be expected.

If any of the CFV-controlled private inholdings are developed and the source of water for those developments is off-site, impacts would occur from the construction of water pipelines or from additional water hauling truck traffic. Either of these methods may have direct and indirect impacts to natural and cultural resources. Construction of new water pipelines would require further analysis under NEPA if the use of federal land would be required.

### Alternative G

#### Direct and Indirect Impacts

Under this alternative, groundwater from Valle would be transported by an underground pipeline to the proposed development. The pipeline would be roughly 25.4 miles in length and constructed in or adjacent to the State Highway 64 right-of-way. Additional NEPA analysis and permitting work would be required prior to construction of this pipeline. Construction of the proposed pipeline would have short-term impacts and may require additional vegetation clearing and ground disturbance in or adjacent to the existing right-of-way corridor.

Water purchased from outlying communities could be used as a supplemental source of water and in emergency situations, and would be hauled by truck to the development. This would increase truck traffic on State Highway 64 and have corresponding impacts to air quality, traffic safety and road conditions. Based on the small quantity of water needed from these sources, these impacts are expected to be minor.

#### Cumulative Impacts

Cumulative impacts under Alternative G would arise from development of CFV, along with the expected continued development of the existing private land in Tusayan. Businesses in Tusayan would continue to haul water by truck and pump groundwater. Additional development in Tusayan is not expected to require expansion of water delivery systems beyond the existing private land boundaries of Tusayan.

### Alternative H

#### Direct and Indirect Impacts

Under Alternative H, water would be hauled via the Burlington Northern/Santa Fe railroad from a siding near Topock, Arizona to a siding near Williams. Water may then be transported from Williams to Apex Siding near Tusayan via rail or piped from Williams to the CFV development. Under this first option, the construction of an underground pipeline from Apex Siding to the CFV development (approximately 4 miles) could result in impacts to natural and cultural resources from ground disturbance and vegetation clearing. Construction of this water pipeline would require additional natural and cultural resource surveys and further analysis under NEPA.

Under the second option, water would be piped approximately 60 miles in an underground pipeline from Williams to the CFV development. Construction of the new water pipeline would occur within or adjacent to existing corridors, and could result in impacts to natural and cultural resources from ground disturbance and vegetation clearing. This pipeline would also require additional natural and cultural resource surveys and further analysis under NEPA.

#### Cumulative Impacts

Because any redevelopment of Tusayan would use existing water delivery systems in the area, little cumulative impacts to water transportation are anticipated under this alternative.

# Socioeconomics

## Grand Canyon/Tusayan Area

**Issue:** Increased competition from additional commercial development in the Grand Canyon/Tusayan area could affect revenues of existing businesses in the Grand Canyon/Tusayan area.

### Methods for Analyzing Impacts

The economic modeling effort, analysis parameters, and assumptions were reviewed based on comments received on the economic analysis presented in the draft EIS. A number of concern areas were identified, and the changes made to the analysis are listed below. These changes, and other aspects of the public comments regarding the economic analysis are discussed in greater detail in the revised economic report in the Appendix.

- Potential impacts to lodging and retail markets in Tusayan are analyzed
- Economic impacts are analyzed on a year by year basis
- The existing penetration rate for Grand Canyon Lodges and Tusayan hotels is estimated to be 31.5% (instead of 28.9% used in the draft EIS), based on new visitation and room supply data
- The model makes adjustments in the amount of new supply developed in each alternative based on estimates of demand associated with each alternative
- The demand estimates consider three visitation growth rates (1.5, 2.5, and 4.0%). The discussion and display of impacts in the Supplement to the draft EIS are based on the 2.5% visitation growth rate —the same rate used in the GCNP GMP
- The model considers the potential different performance of groupings of Grand Canyon/ Tusayan lodging properties (GCNP on-rim, GCNP off-rim, CFV, and Tusayan area properties) and estimates prospective occupancy performance based on assumed market share penetration rates for these groupings

*Resource values?*

Table 4.17 presents the prospective new demand for lodging in the Grand Canyon/Tusayan area based on the 2.5% growth rate considering four different penetration rates: 31.5%, 35%, 38%, and 41.5%. The market penetration rate is the percent of visitors accommodated in a given area. Future penetration rates depend on a wide range of variables, including implementation of the GCNP GMP, the amount and mix of available lodging, the associated pricing and quality, what other visitor support facilities exist, and the impact of additional support facilities on the visitor's length of stay. Based on the actual penetration rates achieved during periods when significant vacancies exist, penetration rates up to approximately ten points above current annual averages (31.5%) are believed to be achievable. A 41.5% penetration rate would imply an approximate 32% increase in overall penetration. This level of penetration would likely require strong competitive pricing, a wider range of available product, and a wider range of support amenities. Table 4.17 differentiates between the growth attributed to the increase in penetration from the existing visitor base and that coming from new visitation growth

As outlined Table 4.17, in addition to new room night demand generated by visitation growth, 4,885 to 13,958 new room nights in the Grand Canyon/Tusayan area would be generated annually by increasing the penetration rate of the current GCNP visitor base above the current estimated penetration rate of 31.5%. This estimate assumes the increase in visitation and in the existing visitor base penetration are achieved over the analysis periods (1998-2010) in equal annual increases. An occupancy level of 70% was used to provide an indication of the number of rooms potentially needed to support this level of demand. It should be noted that the increase in penetration of the existing visitor base can significantly add to overall room demand. As an example, at a 41.5% penetration rate, approximately 40% of total annual new demand (35,882 total new captured room nights) is generated by accommodating a larger percentage of the existing visitor base (13,958 captured room nights from increased penetration).

The higher levels of penetration and associated demand would likely be achieved once implementation of the GCNP GMP was underway and development associated with the various alternatives had commenced. Under the alternatives, these higher penetration rates would likely be achieved by 2001, thus the model assumes the various alternatives would

**Table 4.17 Prospective New Demand for Lodging in the Grand Canyon/Tusayan Area**

| Annual Visitation Growth Rate | Average Annual Growth 1998-2010 | Average Annual New Potential Room Nights[1] | Penetration Rate | Captured Room Nights from New Growth | Captured Room Nights from Increased Penetration[1,2] | Total New Captured Room Nights | Average Annual Rooms Supported[3] |
|---|---|---|---|---|---|---|---|
| 2.5% | 121,070 | 52,831 | 31.5% | 16,642 | 0 | 16,642 | 65 |
| 2.5% | 121,070 | 52,831 | 35.0% | 18,491 | 4,885 | 23,376 | 91 |
| 2.5% | 121,070 | 52,831 | 38.0% | 20,076 | 9,072 | 29,148 | 114 |
| 2.5% | 121,070 | 52,831 | 41.5% | 21,925 | 13,958 | 35,882 | 140 |

1. 2.75 average party size, 1.2 days average length of stay
2. Existing visitor base; 2.75 average party size; 1.2 days average length of stay. Room nights from increased penetration rate of existing visitor base above 31.5% penetration rate
3. Assumes average 70 percent occupancy

experience penetration rates similar to current levels (31.5% during years 1998 to 2000) and then increase to prospectively higher levels. Based on these assumptions, if a 2.5% visitation growth rate was achieved, a total of 847 to 1,600 new rooms could be developed, depending on the associated penetration rate of visitors captured by the Grand Canyon/Tusayan lodging market.

Table 4.18 provides a summary of the cumulative projected impacts to the Grand Canyon/Tusayan area businesses at the 2.5% visitation growth rate for all of the alternatives. The cumulative projected number of lodging rooms to be built ranges from a low of 1,160 under Alternative A, to a high of 2,230 rooms under Alternative B. Under Alternatives B and C, the proposed number of rooms (3,650 and 2,000, respectively) to be built exceeds the estimated number of rooms (2,230 and 1,910, respectively) projected by the model. Under all of the alternatives, the amount of new development that could occur exceeds that which has been projected to be necessary to maintain existing supply/demand relationships; thus, declining occupancy rates for Tusayan properties are expected in all alternatives.

**Table 4.18 Alternative Comparison of Cumulative Impacts to the Grand Canyon/Tusayan Area Businesses at the 2.5% Visitation Growth Rate**

| Alternatives | Number of Rooms Proposed by Alternative | Total Number of Rooms Developed | Average Tusayan Occupancy Rate 1998-2010 | Lowest Tusayan Occupancy Rate 1998-2010 |
|---|---|---|---|---|
| A | Not specifically proposed | 1,160 | 66% | 59% |
| B | 3,650 | 2,230 | 56% | 44% |
| C | 2,000 | 1,910 | 61% | 55% |
| D | 710 | 1,350 | 67% | 62% |
| E and F | Not specifically proposed | 1,360 | 67% | 62% |
| G | 900 | 1,260 | 62% | 49% |
| H | 1,270 | 1,630 | 56% | 47% |

The model projections and analyses indicate that impacts are largely dependent on four variables: how many rooms are actually constructed; when the rooms become available; the penetration rate; and, the rate of visitation growth to GCNP. Under all of the land exchange alternatives, it is assumed that the majority of

the CFV proposed lodging rooms are constructed early in the study period, resulting in economic impacts to existing properties through reduced occupancy rates.

### Alternative A

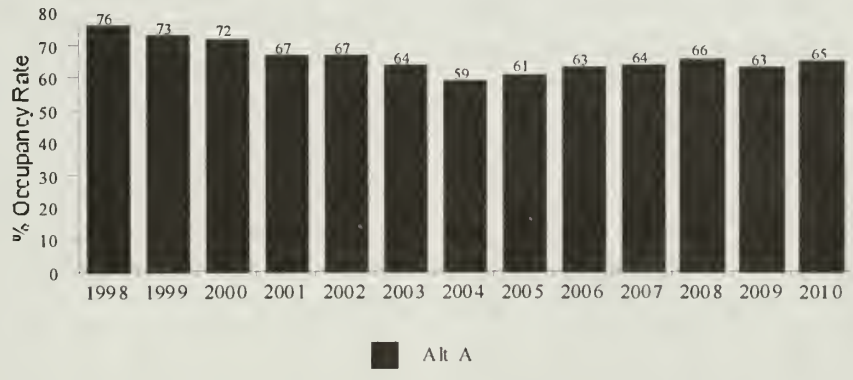
#### Direct and Indirect Impacts

Under Alternative A, penetration rates for the Grand Canyon/Tusayan area are expected to continue at or near the existing level of 31.5%. This equates to annual additions of approximately 65 rooms (at a 70% occupancy level) for a total of 847 rooms through the year 2010. It is unlikely that rooms will be added at this regular rate, and therefore, the following is assumed:

- The Grand (currently under construction in Tusayan) will add 120 rooms in Tusayan, and although it is scheduled to open in 1998, 1999 will be its first full year in operation
- Changes in GCNP lodges will occur as outlined in the GCNP GMP, adding 104 units in 2000, removing 104 units in 2002, and adding 240 rooms by 2004
- New rooms will be constructed in blocks of 100 when occupancy rates in Tusayan reach 65%. Competition to build these rooms could come from both landowners within Tusayan and on private inholdings. Because it is difficult to accurately predict the location of this development, it is assumed that this new supply would occur within the general Tusayan area
- Occupancy rates vary considerably for the Grand Canyon/Tusayan area. On-rim properties are assumed to continue to achieve the highest occupancy rate (92%). Other properties (GCNP off-rim and Tusayan) are assumed to have equal potential to attract prospective visitors, thus it is assumed that demand is evenly split among the GCNP off-rim and Tusayan properties

Based on these assumptions, the model projects that 1,160 new rooms could be added in the Grand Canyon/Tusayan area, under the 2.5% visitation growth rate. This amount of development is above the supportable level at a 31.5% penetration rate (847 rooms based on a 70% average occupancy rate) and reflects the likely supply response by developers to market conditions (i.e., development occurring when an average 65% occupancy rate is achieved). Additional competition would evolve from both GCNP and areas in and around Tusayan. Figure 4.2 presents the projected lodging performance for GCNP off-rim properties in the Grand Canyon/Tusayan area on an annual basis through the year 2010 for Alternative A. As new rooms are added in the Grand Canyon/Tusayan area, average occupancies (excluding GCNP on-rim properties) would fall to 59% as the last units are added at GCNP in 2004. As GCNP off-rim occupancies increase to 66% by 2008, some new development would occur in 2009.

**Figure 4.2 Prospective Occupancy Performance for Off-Rim Properties in Alternative A**



## Alternative B

### Direct and Indirect Impacts

Alternative B proposes the addition of 3,650 new lodging rooms. Under Alternative B, a wide range of available lodging product, development of a staging area and a mass transit system for GCNP visitors, and development of a variety of visitor support facilities could result in this alternative achieving the highest prospective penetration rate, 41.5%. Under a 2.5% visitation growth rate, 35,882 new room nights per year would be required to fulfill the increase in demand from the 10% increase in penetration rate (from 31.5% to 41.5%).

Under Alternative B, the supply of new lodging rooms at the Grand and within GCNP are assumed to be the same as outlined under Alternative A. However, new CFV room supply projected by the model in Alternative B considers the phasing plan outlined in the CFV proposal and market forces. Based on previously explained modeling assumptions, development would follow the phasing schedule proposed by CFV for the first three years. Additional development beyond this point is assumed to be halted (under the 2.5% visitation growth rate), as investors and lenders would likely constrain new development until average occupancies return to the mid-60% range. Under the 2.5% visitation growth rate, additional development would not likely come on-line until 2010. Based on these assumptions, CFV would add approximately 1,870 rooms by 2010, or 51% of the 3,650 rooms proposed in Alternative B. A comparison of the two phasing scenarios is shown in Table 4.19.

Because of the amount of rooms added by CFV, their proximity to the transit center, and the amount and mix of visitor support facilities adjacent to the CFV lodging properties, it is assumed that CFV properties could operate at a higher occupancy level than existing Tusayan properties. Thus, it is assumed that the CFV properties would capture 110% of their market share, allowing for a 9-10% occupancy variance between CFV and other properties (excluding GCNP on-rim properties which it is assumed continue to operate at 92%). Because of the number of rooms added by CFV (1,870), the occupancy rates of Tusayan and GCNP off-rim properties would drop below current levels. The model projects that Tusayan and GCNP off-rim properties would experience a 56% average occupancy level over the 1998 to 2010 time period.

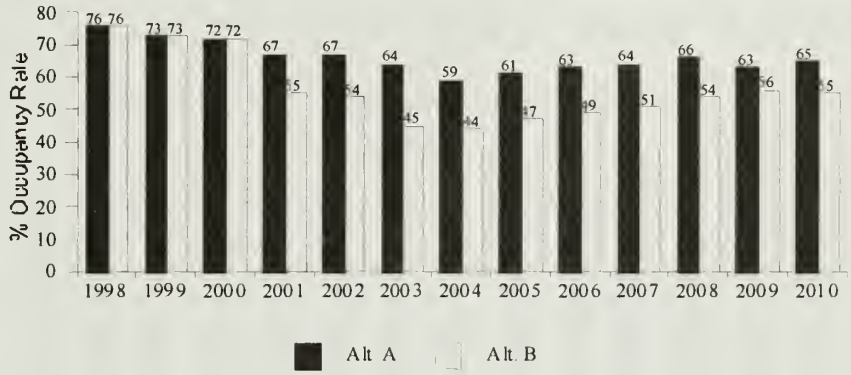
**Table 4.19 Proposed Development Schedule Versus Market Driven Scenario Alternative B**

| | Proposed Development Schedule | Market Driven Development Schedule |
|---|---|---|
| Year 1 | 670 | 670 |
| Year 2 | 320 | 320 |
| Year 3 | 680 | 680 |
| Year 4 | 180 | — |
| Year 5 | 530 | — |
| Year 6 | 180 | — |
| Year 7 | 250 | — |
| Year 8 | 180 | — |
| Year 9 | 180 | — |
| Year 10 | 180 | 200 |
| Year 11 | 150 | Not applicable |
| Year 12 | 150 | Not applicable |
| Total | 3,650 | 1,870 |

Figure 4.3 compares the results of the economic model and projected impacts to the Tusayan hotel market (Tusayan and GCNP off-rim properties) for Alternatives A and B. Because of the number of rooms added in Alternative B, occupancies would drop to the mid-40% range in 2003 and 2004.

A total of 479,000 square feet of retail space is proposed under Alternative B. This total is approximately four times greater than the 108,000 square feet estimated to be needed in the draft EIS under the 2.5% visitation growth rate. To support this level of retail space, spending patterns of visitors would need to increase by 2.5 times current levels. If this level of new retail space was actually developed and spending patterns did not significantly increase, average retail sales volumes for existing retail businesses in the Grand Canyon/Tusayan area could potentially drop to approximately 60% of existing levels.

**Figure 4.3 Tusayan Prospective Occupancy Performance in Alternative B**




### Cumulative Impacts

Under Alternative B, it is assumed that the schedule of proposed construction and removal of lodging rooms in GCNP would occur as specified in the GCNP GMP. This would result in a net increase of 240 rooms inside the park by 2004. These in-park rooms would immediately follow the 1,670 rooms constructed by CFV during the first three years of its development, and would contribute to the decrease in occupancy performance of the Tusayan and GCNP off-rim properties. The cumulative effect of both the CFV and in-park lodging construction results in the lowest projected occupancy rates (44%) for Tusayan and GCNP off-rim properties in 2004.

## Alternative C

### Direct and Indirect Impacts

Alternative C proposes the construction of 2,000 lodging rooms and associated facilities. This level of development could also result in an increase in the penetration rate for the Grand Canyon/Tusayan area, estimated at 38%, an increase of 6.5% over the current penetration rate. Like Alternative B, it is unlikely that all proposed lodging rooms would be constructed when considering market assumptions used in the economic model and analysis. Based on these assumptions, 1,550 rooms would be added between 1998 and 2010, approximately 77% of the 2,000 lodging rooms proposed in Alternative C. A comparison of the proposed phasing schedule of Alternative C with what could occur considering the market assumptions of the economic model is shown in Table 4.20.

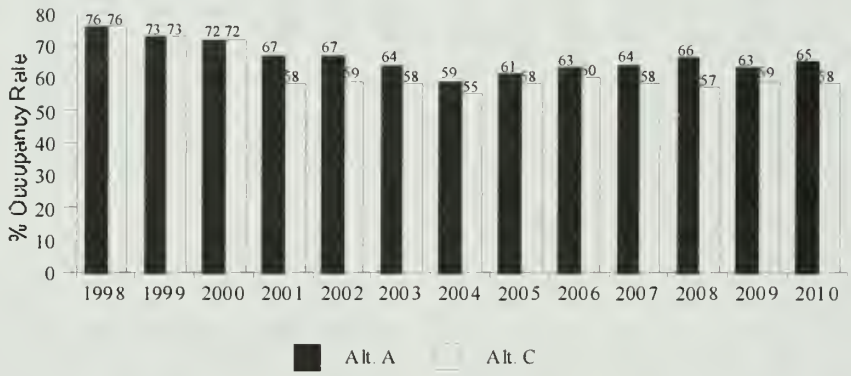
**Table 4.20 Proposed Development Schedule Versus Market Driven Scenario Alternative C**

| | Proposed Development Schedule | Market Driven Development Schedule |
|---|---|---|
| Year 1 | 540 | 540 |
| Year 2 | 240 | 240 |
| Year 3 | 170 | 170 |
| Year 4 | 150 | — |
| Year 5 | 200 | — |
| Year 6 | 150 | — |
| Year 7 | 150 | 200 |
| Year 8 | — | 200 |
| Year 9 | 150 | — |
| Year 10 | — | 200 |
| Year 11 | 150 | Not applicable |
| Year 12 | 100 | Not applicable |
| Total | 2,000 | 1,550 |

Like Alternative B, it is assumed that CFV properties under Alternative C could operate at a higher occupancy level than existing Tusayan properties, including GCNP off-rim properties. Thus, it is assumed that the CFV properties would capture 107% of their market share, allowing for a 6-7% occupancy variance between CFV properties and other properties (excluding GCNP on-rim properties, which it is assumed would continue to operate at 92%). Because of the number of rooms added in Alternative C,

Tusayan occupancies are projected to drop to the high 50% range for the period from 2001 - 2010. Figure 4.4 compares the results of the economic model and projected impacts to the Tusayan lodging market for Alternatives A and C.

**Figure 4.4 Tusayan Prospective Occupancy Performance in Alternative C**




Alternative C proposes 320,000 square feet of new retail space, approximately three times greater than the estimated supportable level. Visitor spending would need to approximately double to support this level of new retail development, or average retail sales volumes at existing businesses in the Grand Canyon/Tusayan area could potentially drop by approximately 50% of existing levels.

### Cumulative Impacts

Under Alternative C, the 240 GCNP lodging rooms added in the park by 2004 would immediately follow the 950 CFV lodging rooms constructed in the first three years of its development. The GCNP in-park properties would contribute to the decrease in occupancy performance of the Tusayan and GCNP off-rim properties, resulting in the lowest projected occupancy rate for these properties of 55% in the year 2004.

## Alternative D

### Direct and Indirect Impacts

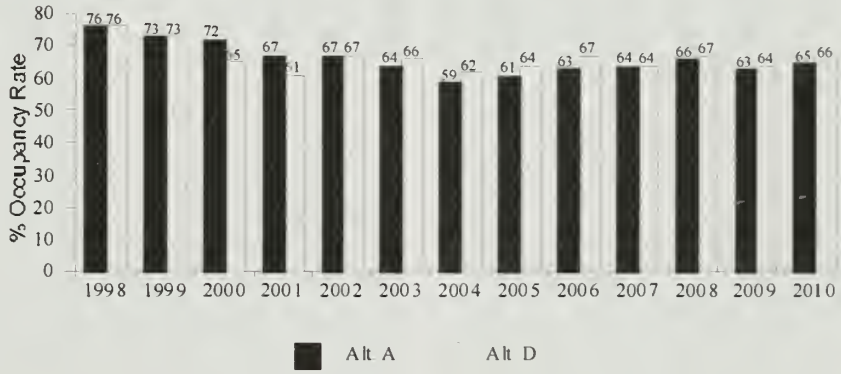
Alternative D proposes the construction of 710 lodging rooms and associated facilities. This level of development could also result in an increase in the penetration rate for the Grand Canyon/Tusayan area, estimated at 35%, an increase of 3.5% over the current penetration rate. An adjustment is made in year 2 to reflect the actual number of rooms at the Grand hotel, with the remaining rooms assumed to be developed in the following year. A comparison of the proposed phasing schedule of Alternative D with what could occur considering market assumptions of the economic model is shown in Table 4.21. Year 1 in Table 4.21 represents the year 1998.

**Table 4.21 Proposed Development Schedule Versus Market Driven Scenario Alternative D**

| | Proposed Development Schedule | Market Driven Development Schedule |
|---|---|---|
| Year 1 | — | — |
| Year 2 | 160 | 120 |
| Year 3 | 160 | 200 |
| Year 4 | 250 | 250 |
| Year 5 | 140 | — |
| Year 6 | — | 140 |
| Year 7 | — | — |
| Year 8 | — | — |
| Year 9 | — | — |
| Year 10 | — | — |
| Year 11 | — | — |
| Year 12 | — | — |
| Total | 710 | 710 |

A comparison of impacts to Tusayan occupancy rates (excluding GCNP on-rim properties) under Alternative D and Alternative A are presented in Figure 4.5. The occupancy rates of Tusayan and GCNP off-rim properties could drop below those of Alternative A in the years 2000 and 2001 because of the larger number of lodging rooms added in the first few years. Occupancies would rise above those of Alternative A in later years as the penetration rate associated with this alternative would allow for greater demand.

**Figure 4.5 Tusayan Prospective Occupancy Performance in Alternative D**




A total of 220,000 square feet of retail space is proposed under Alternative D. This total is twice the amount estimated to be needed at the 2.5% visitation growth rate. To support this level of retail space, spending patterns of visitors would need to increase by approximately 1.5 times the current level. If spending patterns did not increase, average retail sale volumes of existing businesses in the Grand Canyon/Tusayan area could potentially drop to approximately 35% of existing levels.

### Cumulative Impacts

Collectively and according to the model, a total of 1,350 lodging rooms could be constructed in the Grand Canyon/Tusayan area through the year 2010. These rooms could be provided on the existing private land in Tusayan, in GCNP as called for in the GCNP GMP, on private inholdings controlled by CFV, and on outlying private, state, and tribal land. The addition of GCNP in-park properties would contribute to the decrease in occupancy performance of the Tusayan and GCNP off-rim properties, resulting in the lowest projected occupancy rate for these properties of 62% in the year 2004. Two additional 200 unit increments of lodging in years 2007 and 2009 would keep occupancy rates in the mid to high 60% range through 2010.

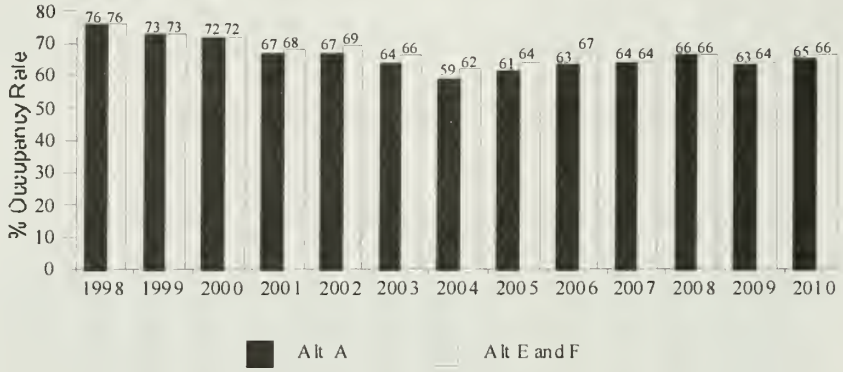
## Alternative E

### Direct and Indirect Impacts

Under Alternative E, the land exchange does not occur and no NFS land is made available to existing business owners and landowners in Tusayan. Although no lodging accommodations and only limited visitor support facilities are proposed in Alternative E, the transportation improvements could result in an increase in the penetration rate for the Grand Canyon/Tusayan area, estimated at 35%, an increase of 3.5% over the current penetration rate. A comparison of impacts to Tusayan occupancy rates (excluding GCNP on-rim properties) under Alternative D and Alternative A are presented in Figure 4.6.

The additional population in the area associated with the proposed 100 units of new federal housing would create some increased demand for retail and food and beverage services. Most likely, this demand would be met by the existing businesses in Tusayan. The transportation staging area proposed under this alternative includes limited retail and food and beverage services for customer convenience, which are not expected to significantly compete with the existing businesses in Tusayan.

**Figure 4.6 Tusayan Prospective Occupancy Performance in Alternatives E and F**




### Cumulative Impacts

Under this alternative, development would be expected on existing private land in Tusayan and on selected private inholdings controlled by CFV, as well as on outlying private, state, or tribal lands. Therefore, the potential cumulative economic impacts to the Grand Canyon/Tusayan area are similar to those described in Alternative D.

## Alternative F

### Direct and Indirect Impacts

Impacts under Alternative F would be the same as described under Alternative E.

### Cumulative Impacts

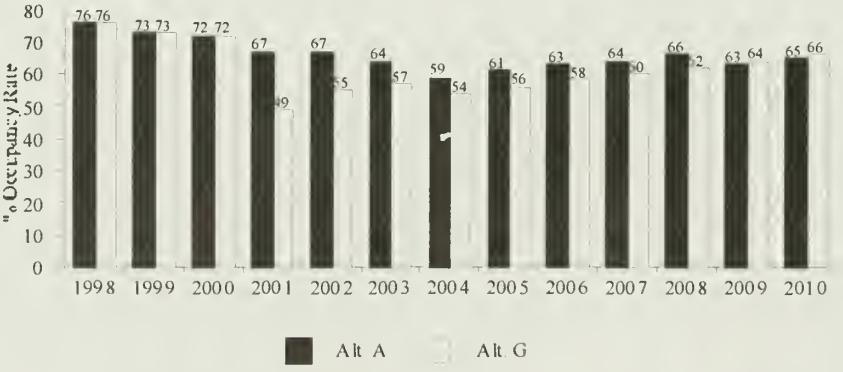
Impacts under Alternative F would be the same as described under Alternative D.

## Alternative G

### Direct and Indirect Impacts

Alternative G proposes the construction of 900 rooms. The penetration rate for Alternative G is expected to be similar to that estimated for Alternative D (35%). With the addition of 900 rooms in 2001, Tusayan occupancy rates are projected to drop to 49% (Figure 4.7). Based on the assumptions in the model, no other lodging rooms would be constructed by CFV or others in the Tusayan area until the occupancy levels reached the mid 60% range (projected to occur in the year 2010). The occupancy rate under Alternative G is expected to remain below the current occupancy rate in the Grand Canyon/Tusayan area, which is estimated to average in the low 70% range.

**Figure 4.7 Tusayan Prospective Occupancy Performance in Alternative G**



A total of 200,00 square feet of retail space is proposed for Alternative G. This amount is approximately double that determined to be supportable based on existing spending patterns. To support this level of retail space, spending patterns of visitors would need to increase by approximately 1.5 times current levels. If spending patterns did not increase, average retail sale volumes of existing businesses in the Grand Canyon/ Tusayan area could potentially drop by approximately 30% of existing levels.

### Cumulative Impacts

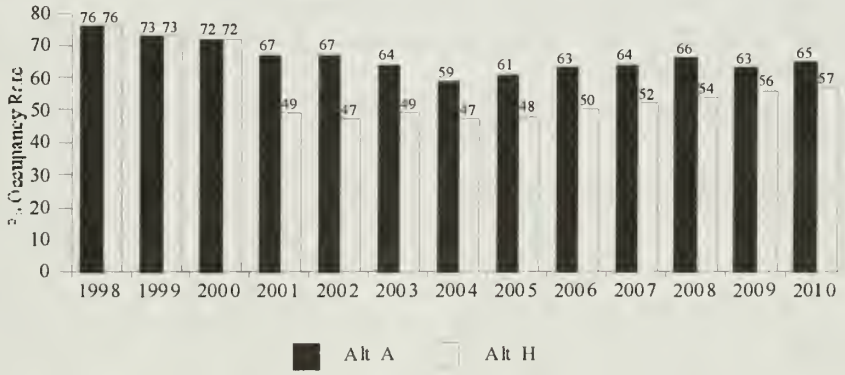
Under Alternative G, the 240 GCNP lodging rooms added in the park by 2004 would follow three years after the 900 CFV lodging rooms are constructed. This would allow the occupancy rate of the Tusayan and GCNP off-rim properties to increase from 49% to 57% before the additional rooms are added. After construction of the additional 240 GCNP rooms, occupancy rates at the Tusayan and GCNP off-rim properties would drop to 54%.

## Alternative H

### Direct and Indirect Impacts

Alternative H proposes 900 lodging rooms in the first year (2001) and 320 additional rooms and 50 hostel beds in the second year, for a total of 1,270 lodging units. With this amount of development, the model projects that no other lodging rooms, except the 240 in-park rooms proposed in the GCNP GMP, would be constructed through the year 2010. A 35% penetration rate is assumed to be achievable in this alternative. Figure 4.8 presents potential impacts to existing Tusayan and GCNP off-rim properties occupancy rates under this Alternative. Figure 4.8 indicates that Tusayan and GCNP off-rim properties occupancy rates would drop to the high 40% range with the addition of these units in 2001, and continue to drop in 2002 with the additional 370 units. The occupancy rates of Tusayan and GCNP off-rim properties are projected to increase to 57% by 2010.

**Figure 4.8 Tusayan Prospective Occupancy Performance in Alternative H**




In the economic analysis, the 50 hostel beds proposed in Alternative H were modeled as lodging rooms. It should be noted that these hostel beds may not directly compete with other lodging facilities in the Grand Canyon/Tusayan area.

A total of 270,000 square feet of retail space is proposed under Alternative H. This amount is more than double that determined to be economically supportable. To support this level of retail space, spending patterns of visitors would need to increase by 1.7 times that of current levels. If they did not, the average retail sales volumes of existing retail businesses in the Grand Canyon/Tusayan area could potentially drop to approximately 40% of current levels.

### Cumulative Impacts

Under Alternative H, the 240 GCNP lodging rooms are assumed to be added by 2004, two years after the 1,270

CFV lodging units are constructed. Collectively, construction of the CFV units and GCNP in-park rooms would hold the occupancy rates for the Tusayan and GCNP off-rim properties in the 40% range for five years. Occupancy rates would begin to increase after 2004. By the year 2010, the average occupancy rate for the Tusayan and GCNP off-rim properties are projected to increase to the high 50% range.

## Other Outlying Communities

**Issue:** Development in the Tusayan area could affect the economy of a number of communities by diverting Grand Canyon tourist revenue.

### Methods for Analyzing Impacts

Comments received on the draft EIS challenged the analysis of impacts to outlying communities by stating that the vast majority (90 to 100%) of the room-night displacement would come from northern Arizona, and would not be proportionately shared across the wider region. While both actual market experience and survey data support the draft EIS analysis (i.e., ability to displace room nights from a region beyond northern Arizona), the revised economic analysis outlines impacts to outlying communities for a range of displacement assumptions: 50, 70, and 90% from northern Arizona.

Table 4.22 provides a summary of the cumulative projected impacts to the other outlying communities at the 70% displacement and 2.5% visitation growth rate for all of the alternatives. In the discussion and tables (Table 4.23, Table 4.24, Table 4.25) under each of the alternatives, impacts to outlying communities at the 50% and 90% displacement factors are outlined.

As outlined in Table 4.22, Alternative A would result in no displacement to northern Arizona communities, while Alternative B, with the highest increase in penetration rate (41.5%), would result in the greatest amount of displaced rooms and spending. Alternatives D, E, F, G, and H are estimated to experience similar penetration rates (35%) and each would displace approximately $6.6 million in spending and 185 rooms over the 13 year period.

**Table 4.22 Summary of Cumulative Impacts to Outlying Communities in Northern Arizona at a 2.5% Visitation Growth Rate, 70% Occupancy Rate, and 70% Displacement**

| Alternatives | Assumed Penetration Rate for Grand Canyon/ Tusayan Area | Displaced Rooms 1998-2010 | Displaced Spending 1998-2010 | Lost Taxes 1998-2010 |
|---|---|---|---|---|
| A | 31.5% | ND[1] | ND[1] | ND[1] |
| B | 41.5% | 527 | $18,855,200 | $549,882 |
| C | 38% | 342 | $12,255,880 | $357,423 |
| D | 35% | 185 | $6,599,320 | $192,459 |
| E | 35% | 185 | $6,599,320 | $192,459 |
| F | 35% | 185 | $6,599,320 | $192,459 |
| G | 35% | 185 | $6,599,320 | $192,459 |
| H | 35% | 185 | $6,599,320 | $192,459 |

1. No displacements/economic impacts

### Alternative A

#### Direct, Indirect, and Cumulative Impacts

Under Alternative A, it is assumed that current market demand characteristics remain essentially unchanged, and that the Grand Canyon/Tusayan area would continue to achieve penetration rates at or near current levels (31.5%). Northern Arizona communities would thus continue to maintain their current share of Grand Canyon related lodging demand, and experience little economic impact.

### Alternative B
Direct, Indirect, and Cumulative Impacts
The increase in the penetration rate under Alternative B to 41.5% would displace room nights from other areas with associated economic impacts. Table 4.23 shows the projected range of economic impacts to outlying communities in northern Arizona considering 50 and 90% displacement factors. Annual room displacement could range from 38 to 68 rooms at a 70% occupancy level, with displaced spending ranging from 1.3 to 2.4 million annually, and lost tax revenue ranging from $39,000 to $71,000 annually.

### Alternative C
Direct, Indirect, and Cumulative Impacts
With the increase in penetration rate in the Grand Canyon/Tusayan area to 38% under Alternative C, room nights would be displaced from other communities. Table 4.24 shows the projected range of economic impact to outlying communities in northern Arizona at 50 to 90% displacement factors. Annual room displacement in northern Arizona could range from 25 to 44 rooms at 70% occupancy level, with annual displaced spending ranging from $875,000 to $1.6 million and lost taxes from $26,000 to $46,000.

### Alternative D
Direct, Indirect, and Cumulative Impacts
Under Alternative D, as the penetration rate in the Grand Canyon/Tusayan area increases to 35%, room nights would be displaced from other communities. Table 4.25 shows the projected range of economic impact to outlying communities in northern Arizona at the 50 to 90% displacement factors. Annual room displacement in northern Arizona could range from 13 to 23 rooms at a 70% occupancy level, with annual displaced spending ranging from $471,000 to $850,000 and lost taxes from $14,000 to $25,000.

### Alternative E
Direct, Indirect, and Cumulative Impacts
As the estimated penetration rate for Alternative E is similar to that considered under Alternative D, economic impacts to northern Arizona communities are expected to be similar to those described in Alternative D.

### Alternative F
Direct, Indirect, and Cumulative Impacts
As the estimated penetration rate for Alternative F is similar to that considered under Alternative D, economic impacts to northern Arizona communities are expected to be similar to those described in Alternative D.

### Alternative G
Direct, Indirect, and Cumulative Impacts
As the estimated penetration rate for Alternative G is similar to that considered under Alternative D, economic impacts to northern Arizona communities are expected to be similar to those described in Alternative D.

### Alternative H
Direct, Indirect, and Cumulative Impacts
As the estimated penetration rate for Alternative H is similar to that considered under Alternative D, economic impacts to northern Arizona communities are expected to be similar to those described in Alternative D.

## Housing

**Issue:** There is a need for additional housing for both federal and concessionaire employees within GCNP and for employees of Tusayan businesses. Issues include who would build the housing, who would pay for the housing to be built, how many housing units are needed, what types of housing are needed, and what is the distribution of housing types and affordability offered.

### Methods for Analyzing Impacts
No new methods are proposed.

### Alternative F
Direct and Indirect Impacts
Under Alternative F, the U.S. Departments of Agriculture and Interior would execute an interagency agreement for the use of NFS land for federal employee housing. This alternative calls for the construction of 100 units of housing for NPS employees and their families. Construction of these units would be contingent on NPS securing funds. These units would be built by a contractor selected by NPS through competitive bidding. Rental rates for the federal housing complex would be established using a government formula. Employees of the park concessionaire who need an estimated 400 lodging units, would have to find housing elsewhere along with other Tusayan area employees.

**Table 4.23 Economic Impacts to Outlying Communities in Alternative B**

| | 50 Percent Displacement | | 90 Percent Displacement | |
|---|---|---|---|---|
| | Annual Impacts | Total Impacts[1] | Annual Impacts | Total Impacts[1] |
| New Room Demand at 41.5% Penetration Rate[2] | 140 | 1,404 | 140 | 1,404 |
| New Room Demand at 31.5% Penetration Rate[3] | 65 | 651 | 65 | 651 |
| Displaced Room Demand | 75 | 753 | 75 | 753 |
| Percent of Displacement to Northern Arizona | 50% | 50% | 90% | 90% |
| Displacement of Rooms to Northern Arizona | 38 | 377 | 68 | 678 |
| **Flagstaff (40%)** | | | | |
| Displaced Rooms | 15 | 151 | 27 | 271 |
| Displaced Expenditures | $538,720 | $5,387,200 | $969,696 | $9,696,960 |
| Displaced Retail Sales Tax Revenue | $13,160 | $131,602 | $23,688 | $236,883 |
| **Williams (15%)** | | | | |
| Displaced Rooms | 6 | 56 | 10 | 102 |
| Displaced Expenditures | $202,020 | $2,020,200 | $363,636 | $3,636,360 |
| Displaced Retail Sales Tax Revenue | $7,882 | $78,824 | $14,188 | $141,883 |
| **Sedona (15%)** | | | | |
| Displaced Rooms | 6 | 56 | 10 | 102 |
| Displaced Expenditures | $202,020 | $2,020,200 | $363,636 | $3,636,360 |
| Displaced Retail Sales Tax Revenue | $8,961 | $89,610 | $16,130 | $161,299 |
| **Page (10%)** | | | | |
| Displaced Rooms | 4 | 38 | 7 | 68 |
| Displaced Expenditures | $134,680 | $1,346,800 | $242,424 | $2,424,240 |
| Displaced Retail Sales Tax Revenue | $4,637 | $46,368 | $8,346 | $83,463 |
| **Other Northern Arizona Communities (20%)** | | | | |
| Displaced Rooms | 7 | 76 | 14 | 135 |
| Displaced Expenditures | $269,360 | $2,693,600 | $484,848 | $4,848,480 |
| Displaced Retail Sales Tax Revenue | $4,637 | $46,368 | $8,346 | $83,463 |
| **Total Northern Arizona** | | | | |
| Displaced Rooms | 38 | 377 | 68 | 678 |
| Displaced Expenditures | $1,346,800 | $13,468,000 | $2,424,240 | $24,242,400 |
| Displaced Retail Sales Tax Revenue | $39,277 | 392,772 | $70,698 | $706,991 |

1. Penetration rate does not change until year 2001, when the Grand Canyon Transit Center expects to begin operation.
2. Room demand in Grand Canyon/Tusayan market at 41.5% penetration rate, including demand from new visitation growth and from existing visitation base.
3. Room demand in Grand Canyon/Tusayan market at 31.5% penetration rate.

**Table 4.24 Economic Impacts to Outlying Communities in Alternative C**

| | 50 Percent Displacement | | 90 Percent Displacement | |
|---|---|---|---|---|
| | Annual Impacts | Total Impacts[1] | Annual Impacts | Total Impacts[1] |
| New Room Demand at 41.5% Penetration Rate[2] | 114 | 1,141 | 114 | 1,141 |
| New Room Demand at 31.5% Penetration Rate[3] | 65 | 651 | 65 | 651 |
| Displaced Room Demand | 49 | 490 | 49 | 490 |
| Percent of Displacement to Northern Arizona | 50% | 50% | 90% | 90% |
| Displacement of Rooms to Northern Arizona | 25 | 245 | 44 | 441 |
| **Flagstaff (40%)** | | | | |
| Displaced Rooms | 10 | 98 | 17 | 177 |
| Displaced Expenditures | $350,168 | $3,501,680 | $630,302 | $6,303,024 |
| Displaced Retail Sales Tax Revenue | $8,554 | $85,541 | $15,397 | $153,974 |
| **Williams (15%)** | | | | |
| Displaced Rooms | 4 | 37 | 7 | 66 |
| Displaced Expenditures | $131,313 | $1,313,130 | $236,363 | $2,363,634 |
| Displaced Retail Sales Tax Revenue | $5,124 | $51,236 | $9,222 | $92,224 |
| **Sedona (15%)** | | | | |
| Displaced Rooms | 4 | 37 | 7 | 66 |
| Displaced Expenditures | $131,313 | $1,313,130 | $236,363 | $2,363,634 |
| Displaced Retail Sales Tax Revenue | $5,825 | $58,247 | $10,484 | $104,844 |
| **Page (10%)** | | | | |
| Displaced Rooms | 2 | 24 | 4 | 44 |
| Displaced Expenditures | $87,542 | $875,420 | $157,576 | $1,575,756 |
| Displaced Retail Sales Tax Revenue | $3,014 | $30,139 | $5,425 | $54,251 |
| **Other Northern Arizona Communities (20%)** | | | | |
| Displaced Rooms | 5 | 49 | 9 | 88 |
| Displaced Expenditures | $175,084 | $1,750,756 | $315,151 | $3,151,512 |
| Displaced Retail Sales Tax Revenue | $3,014 | $30,139 | $5,425 | $54,251 |
| **Total Northern Arizona** | | | | |
| Displaced Rooms | 25 | 245 | 44 | 441 |
| Displaced Expenditures | $875,420 | $8,754,200 | $1,575,756 | $15,757,560 |
| Displaced Retail Sales Tax Revenue | $25,531 | $255,302 | $45,953 | $459,544 |

1. Penetration rate does not change until year 2001, when the Grand Canyon Transit Center expects to begin operation.
2. Room demand in Grand Canyon/Tusayan market at 41.5% penetration rate, including demand from new visitation growth and from existing visitation base.
3. Room demand in Grand Canyon/Tusayan market at 31.5% penetration rate.

**Table 4.25 Economic Impacts to Outlying Communities in Alternatives D, E, F, G, and H**

| | 50 Percent Displacement | | 90 Percent Displacement | |
|---|---|---|---|---|
| | Annual Impacts | Total Impacts[1] | Annual Impacts | Total Impacts[1] |
| New Room Demand at 41.5% Penetration Rate[2] | 91 | 915 | 91 | 915 |
| New Room Demand at 31.5% Penetration Rate[3] | 65 | 651 | 65 | 651 |
| Displaced Room Demand | 26 | 264 | 26 | 264 |
| Percent of Displacement to Northern Arizona | 50% | 50% | 90% | 90% |
| Displacement of Rooms to Northern Arizona | 13 | 132 | 23 | 238 |
| **Flagstaff (40%)** | | | | |
| Displaced Rooms | 5 | 53 | 9 | 95 |
| Displaced Expenditures | $188,552 | $1,885,520 | $339,394 | $3,393,936 |
| Displaced Retail Sales Tax Revenue | $4,606 | $46,061 | $8,291 | $82,909 |
| **Williams (15%)** | | | | |
| Displaced Rooms | 2 | 20 | 4 | 36 |
| Displaced Expenditures | $70,070 | $707,070 | $127,273 | $1,272,726 |
| Displaced Retail Sales Tax Revenue | $2,759 | $27,588 | $4,966 | $49,659 |
| **Sedona (15%)** | | | | |
| Displaced Rooms | 2 | 20 | 4 | 36 |
| Displaced Expenditures | $70,070 | $707,070 | $127,273 | $1,272,726 |
| Displaced Retail Sales Tax Revenue | $3,136 | $31,364 | $5,645 | $56,454 |
| **Page (10%)** | | | | |
| Displaced Rooms | 1 | 13 | 2 | 24 |
| Displaced Expenditures | $47,138 | $471,380 | $84,848 | $848,484 |
| Displaced Retail Sales Tax Revenue | $1,623 | $16,229 | $2,921 | $29,212 |
| **Other Northern Arizona Communities (20%)** | | | | |
| Displaced Rooms | 3 | 26 | 4 | 47 |
| Displaced Expenditures | $94,276 | $942,760 | $169,697 | $1,696,968 |
| Displaced Retail Sales Tax Revenue | $1,623 | $16,229 | $2,921 | $29,212 |
| **Total Northern Arizona** | | | | |
| Displaced Rooms | 13 | 132 | 23 | 238 |
| Displaced Expenditures | $471,380 | $4,713,800 | $848,484 | $8,484,840 |
| Displaced Retail Sales Tax Revenue | $13,747 | $137,471 | $24,744 | $247,446 |

1. Penetration rate does not change until year 2001, when the Grand Canyon Transit Center expects to begin operation.
2. Room demand in Grand Canyon/Tusayan market at 41.5% penetration rate, including demand from new visitation growth and from existing visitation base.
3. Room demand in Grand Canyon/Tusayan market at 31.5% penetration rate.

### Cumulative Impacts

No private-sector housing would be available on NFS land. Therefore, the housing situation for existing and new businesses in the Grand Canyon/Tusayan area would be expected to be similar to current conditions, which are described below.

Housing for Tusayan area employees could be provided in Tusayan, on the private inholdings if developed, or in the outlying communities of Valle, Williams, and Flagstaff. Little open market housing has been built on private land in Tusayan to date because profits from housing are low and construction costs are high. For new commercial development in Tusayan or on the private inholdings, it is likely that Coconino County would continue to require that developers/employers provide employee housing. Recently, some employers have developed housing outside of Tusayan, for instance in Valle, and transport their employees to and from Tusayan by bus.

It is possible that private land may be subdivided and sold, apartment complexes built and rented, or other housing provided. These possibilities would be considered more likely if a developer could profit from the venture. Private inholdings such as Kotzin and TenX are suitable for such development. Should this occur, it is likely that these housing units could be made available for purchase or rent to park and concessionaire employees, as well as to other employees in the Tusayan area. Such housing could also be made available for purchase or lease to persons wishing a second home or recreational lot near Grand Canyon. Further development would likely result in more housing in various areas in Tusayan, on the private inholdings, in Valle, or in other surrounding communities. Such piecemeal development would continue to preclude the development of a centralized community of residents and community services.

## Alternative G

### Direct and Indirect Impacts

To serve its own employees, CFV would build and manage about 434 units, composed of apartments, dormitories, and townhomes. Apartments and dormitories would be leased at an average of $650 and $455 per unit per month. In addition, CFV would provide 50 trailer/manufactured home pads on 10 acres for lease to area residents at market rates. Lease rates would not be subsidized. Finally, CFV would make available 20 acres of improved land for lease at market rate for park concessionaire and/or NPS employee housing. No vacation or second homes would be permitted.

The NPS, other federal agencies, and park concessionaire would be required to finance and construct their own employee housing, subject to the architectural and design guidelines established for the CFV development. Housing guidelines and restrictions would be enforced by the Kaibab Institute.

The housing solution proposed in Alternative G provides an improved land base to accommodate the housing needs expressed in the GCNP GMP for NPS and park concessionaire employee housing outside park boundaries.

### Cumulative Impacts

Under Alternative G, redevelopment of Tusayan is expected to occur to a certain degree simultaneously with the implementation of this alternative. Coconino County requires that developers provide housing for their employees (per the Tusayan Area Plan), thus additional development within the existing Tusayan townsite would necessitate additional housing for employees associated with these developments. Such housing could be constructed in Tusayan, Valle, or in part on the 10 acres set aside under this alternative for housing for area residents.

## Alternative H

### Direct and Indirect Impacts

To serve its own employees, CFV would build and manage about 517 housing units, composed of apartments, dormitories, and townhomes. Apartments and dormitories would be leased at an average of $650 and $455 per unit per month. In addition, CFV would initially provide 50 townhome and garden units for sale or lease to area residents at market or subsidized rates. Rental rates would be similar to those proposed for CFV employees. Additional units for area residents could be provided if the demand warrants. Rents paid for by employees would be subsidized by the commercial aspects of the development. The Kaibab Institute would be created to ensure that rents and

home prices remain within the affordable range for employees in the area.

CFV would also make available 20 acres of improved land for lease at market rate for NPS and/or park concessionaire employee housing. No vacation or second homes would be permitted. The NPS, other federal agencies, and park concessionaire would be required to finance and construct their own employee housing subject to the architectural and design guidelines established for the CFV development. Housing guidelines and restrictions would be enforced by the Kaibab Institute.

The housing solution proposed in Alternative H provides an improved land base to accommodate the housing needs expressed in the GCNP GMP for NPS and park concessionaire employee housing outside park boundaries. Alternative H also provides for home ownership which accommodates a desire expressed by Grand Canyon/Tusayan area residents.

### Cumulative Impacts
The cumulative impacts of Alternative H would be the same as described under Alternative G

## Employment Opportunities

**Issue:** Development near Tusayan may provide additional employment opportunities.

### Methods for Analyzing Impacts
No new methods are proposed.

### Alternative F
#### Direct and Indirect Impacts
Employment opportunities under Alternative F would be limited because of the limited amount of development proposed. Table 4.26 presents the employment opportunities that could be generated under Alternative F. The limited level of development proposed in this alternative would also limit the amount of induced employment. Few secondary jobs would be created under this alternative.

**Table 4.26 Employment Opportunities in Alternative F**

| Type of Work | Number of Employees |
|---|---|
| Transit Center | 28 |
| Community | 43 |
| Total | 71 |

#### Cumulative Impacts
Implementation of this alternative would not preclude development of the private inholdings controlled by CFV and redevelopment of Tusayan. Additional employment opportunities in construction and service sectors could therefore occur, depending upon the level of development on the private inholdings and other private, state, and tribal land in the area.

### Alternative G
#### Direct and Indirect Impacts
Alternative G would create a range of additional employment opportunities, primarily in the service related industry. The 1,031 jobs created by this alternative are summarized in Table 4.27. A small amount of induced employment could also occur in Tusayan and in the outlying communities to support the increased resident population created by the development.

**Table 4.27 Employment Opportunities in Alternative G**

| Type of Work | Number of Employees |
|---|---|
| Lodging | 180 |
| Food and Beverage | 456 |
| Administration | 90 |
| Community/Office Space | 160 |
| Educational | 100 |
| Community | 45 |
| Total | 1,031 |

#### Cumulative Impacts
Cumulatively, a substantial increase in employment is expected to occur in the Tusayan area under Alternative G. Implementation of Alternative G would not preclude the redevelopment of Tusayan, which would also create additional employment opportunities

in the area. The amount of additional employment could be equal to that described under Alternative D (another 1,000 new employees). Outside the Tusayan area, employment in the visitor service industry is expected to grow considerably throughout northern Arizona as businesses expand to meet increasing visitation demands at Grand Canyon.

### Alternative H

#### Direct and Indirect Impacts

Alternative H would create a range of additional employment opportunities, primarily in the service related industry. The 1,337 jobs created by this alternative are summarized in Table 4.28. A small amount of induced employment could also occur in Tusayan and in the outlying communities to support the increased resident population created by the development.

**Table 4.28 Employment Opportunities in Alternative H**

| Type of Work | Number of Employees |
|---|---|
| Lodging | 276 |
| Food and Beverage | 666 |
| Administration | 90 |
| Community/Office Space | 160 |
| Educational | 100 |
| Community | 45 |
| **Total** | **1,337** |

#### Cumulative Impacts

The cumulative effects of Alternative H would be similar to those described under Alternative G.

## Crime Rates

**Issue:** Additional population growth and visitation resulting from development of the private or NFS lands near Tusayan could increase crime rates in the Grand Canyon/Tusayan area.

### Methods for Analyzing Impacts

No new methods are proposed.

### Alternative F

#### Direct and Indirect Impacts

Although unimproved land would be available under Alternative F for a police/fire station, no funding commitments have been made to purchase the NFS land at market value, construct the infrastructure and buildings, and purchase the necessary equipment. In the interim time period before additional police and fire facilities would be built, DPS would continue to station an officer in Tusayan, the KNF would provide a law enforcement officer to patrol the NFS land, and Forest Service and NPS personnel would continue to provide law enforcement in KNF and GCNP. The consolidation of parking for GCNP visitors could create additional opportunities for criminal activities. The transit center permittee would be responsible for providing security at the parking lot and transit center.

#### Cumulative Impacts

Cumulatively, implementation of this alternative would not preclude development of some of the inholdings controlled by CFV. Additional development could occur throughout the region, requiring existing law enforcement personnel to patrol areas that were previously undeveloped and emergency response time could be increased.

### Alternative G

#### Direct and Indirect Impacts

Under Alternative G, improved land or building space would be designated and made available for lease at market rate for a police/fire station. Additional funding would have to be secured to construct and equip the facility. If constructed, emergency response time would be reduced.

The CFV development and consolidation of parking for GCNP visitors could create additional opportunities for criminal activities. The transit center permittee would be responsible for providing security at the parking lot and transit center. Individual businesses in CFV would also provide additional security personnel.

#### Cumulative Impacts

Implementation of Alternative G would not preclude the redevelopment of Tusayan, which could also create additional opportunities for criminal activities. Additional law enforcement personnel would be necessary to patrol development at CFV and in Tusayan.

### Alternative H

#### Direct and Indirect Impacts

Under this alternative, CFV would build, equip, and donate a law enforcement substation to Coconino County. CFV would also build, equip, and donate a fire station to the Tusayan Fire District. These facilities would reduce emergency response time to criminal occurrences which may increase from the provision of visitor facilities and services at the CFV development and the consolidating of parking for GCNP visitors.

#### Cumulative Impacts

Implementation of Alternative H would not preclude the redevelopment of Tusayan, which could also create additional opportunities for criminal activities. Response times in Tusayan would be reduced from the provision of law enforcement and fire facilities in the adjacent CFV development.

## Community Infrastructure

**Issue:** As visitation to the park continues to increase, the need to expand existing facilities or provide new facilities for schools, police and fire protection, medical services, and other community services will increase.

### Methods for Analyzing Impacts

No new methods are proposed.

### Alternative F

#### Direct and Indirect Impacts

**Community Services and Facilities**

Table 4.29 shows the community services and facilities that could be provided in Alternative F and how they would be financed. Under Alternative F, individual local governmental entities (e.g., fire district, school district) could purchase NFS land under the Townsite Act to implement individual components of the community plan. The local governmental entities would be responsible for raising the funds necessary to purchase the land at market value, construct the basic infrastructure, and construct and equip the facilities. Facilities that could be built if funding becomes available include a school, police/fire station, and community hall. The community hall could be used for various functions—Chamber of Commerce, library, shared worship facility, or other desired community facilities. Currently, there is no local governing body for Tusayan. When population and other requirements are met, the incorporation of Tusayan would provide additional opportunities for financing the community facilities.

**Table 4.29 Disposition of Community Services and Facilities in Alternative F**

| Community Service or Facility | Land Area | | Infrastructure | | Building | |
|---|---|---|---|---|---|---|
| | Contributed | Sold to User | Contributed | Paid by User | Contributed | Paid by User |
| School | | X | | X | | X |
| Police Station | | X | | X | | X |
| Fire Station | | X | | X | | X |
| Community Center | | X | | X | | X |
| Medical Clinic | | X | | X | | X |
| Library | | X | | X | | X |
| Post Office | | X | | X | | X |

**Police and Fire Protection**

NFS land would be made available for purchase by the Tusayan Fire District to build a fire station. NFS land would also be made available for purchase by the county, and potentially the community of Tusayan, if it incorporates in the future, for a police/fire station.

Until financing can be secured to purchase the NFS land and construct the infrastructure and facilities,

existing police and fire protection would remain the same. Law enforcement services in Tusayan would continue to be limited to a DPS officer stationed in Tusayan, three Coconino County Sheriff's deputies stationed in Williams, and Forest Service and NPS law enforcement personnel. Fire protection services would be provided by the KNF, NPS, and potentially the Tusayan Fire District.

**Medical Facility**
The community center, if constructed, could provide office space for lease to a health care provider. If additional medical services are not provided, the medical services and facilities within GCNP could be used beyond capacity.

**Sewage**
The transit center would generate an estimated 70,000 gallons per day of wastewater. This wastewater would be transferred to the SGCSD wastewater treatment plant through six-inch to ten-inch diameter pipes, requiring installation of an estimated one-half to one mile of pipeline. The wastewater treatment plant has a capacity of 750,000 gallons per day, and currently, could accommodate the additional volume produced by the proposed transit center.

**Solid Waste**
Using the EPA average waste generation of four pounds per person per day, approximately 800 pounds of waste would be generated daily by the federal housing complex in Alternative F. Considering the size and capacity of the Grand Canyon Transit Center, approximately 16,000 pounds of waste would be generated daily at the transit center. Solid waste from the transit center and federal housing complex would be reduced through a basic recycling program. Because of the uncertainty of what would be built on the Townsite Act land, estimates on waste generation can not be made with accuracy. However, based on the mix of proposed facilities and employment estimates, no more than 600 pounds of waste would be generated daily from the community facilities.

Solid waste would be hauled to a county-operated transfer station approximately three miles southeast of Tusayan. From there, the county hauls the waste to the City of Flagstaff landfill. The amount of waste generated and deposited at the transfer facility from the transportation, federal housing, and community development proposed under Alternative F may require Coconino County to make multiple trips per day to haul waste from the transfer station to the landfill.

**Tax Revenue**
The Forest Service makes payment to counties with respect to federal land under two statutes known as the Payment in Lieu of Taxes (PILT) and the Twenty-Five Percent (25%) Fund. The PILT Act of 1976 authorizes payments to counties based on the number of acres of entitlement land within the county. For purposes of this discussion, entitlement land is NFS land. The 25% Fund of May 23, 1908, provides for counties to receive 25% of the gross receipts and revenues from timber sales and other income-generating activities on federal land. On the NFS land under special use permit for the transit center and parking lot, PILT and 25% payments would be made to the county.

### Cumulative Impacts
The cumulative impact of growth in Tusayan and potential development of the private inholdings controlled by CFV would result in a greater demand to expand or provide new facilities for police and fire protection, medical services, and other community services. The Tusayan Area Plan provides some provisions for future development; however, there is no land-use or financing plan for Tusayan that assures the provision of community services.

Solid waste generated as a result of development of the Kotzin and TenX private inholdings would most likely be hauled to the county transfer station and then to the Flagstaff landfill. No transfer stations are located near the Lower Basin private inholding, so solid waste generated from development at Lower Basin would be taken directly to the Flagstaff landfill. Potential cumulative impacts could result if the Tusayan transfer station is continually inundated with waste, requiring the county to make multiple trips per day to haul waste from the transfer station to the landfill. Cumulative impacts to the landfill could occur if other municipalities in Coconino County also decide to haul solid waste to the landfill. Additionally, the need for funding to further expand the landfill may require

raising tipping fees and costs charged to Flagstaff and Coconino County residents.

Collectively, the redevelopment of Tusayan and development of the private inholdings for commercial purposes would result in higher property tax revenues, additional business and employment taxes, and additional sales tax revenues for the county.

## Alternative G

### Direct and Indirect Impacts

**Community Services and Facilities**

Table 4.30 shows the community services and facilities that could be provided in Alternative G and how they would be financed. Under this alternative, CFV would build a 4,000 square foot community center available to all area residents, and donate 21 acres of improved land for a school to the local school district. Additional improved land or building space would be sold or leased at market rate for community facilities such as a cemetery, medical clinic, police and fire station, library, and houses of worship. CFV would build playgrounds and gathering areas within the residential areas that would be available for all area residents. Local governmental entities would be responsible for raising the funds necessary to lease or purchase the improved land, and construct and equip the community facilities. Currently, there is not a local governing body for Tusayan. With the development of CFV, the overall population of Tusayan may allow for incorporation. The incorporation of Tusayan would provide additional opportunities for financing the community facilities.

**Table 4.30 Disposition of Community Services and Facilities in Alternative G**

| | Land Area | | Infrastructure[1] | | Building | |
|---|---|---|---|---|---|---|
| Community Service or Facility | Contributed | Sold or Leased to User | Contributed | Paid for by User | Contributed | Paid for by User |
| School | X | | X | | | X |
| Police Station | | X | X | | | X |
| Fire Station | | X | X | | | X |
| Community Center | X | | X | | X | |
| Medical Clinic | | X | X | | | X |
| Library | | X | X | | | X |
| Post Office | | X | X | | | X |
| Parks | X | | X | | X | |
| House(s) of Worship | | X | X | | | X |
| Cemetery | | X | X | | | X |

1. Basic infrastructure (access and utility hook-up) would be provided by CFV. A portion of these costs would be recouped through lease rates.

**Police and Fire Protection**

CFV would provide improved land or building space for sale or lease at market rate for a police and fire station to serve the CFV development, and potentially, the Tusayan area. Additional funding would have to be secured by the local fire district or county to lease improved land or building space, and construct and equip the facilities. If the local fire district is unable to secure the necessary funds, CFV would provide private fire protection services for the CFV development. If incorporation occurs, the police and fire station could be financed by the municipality. Until a financing commitment is secured, existing law enforcement services would remain the same (three Coconino County Sheriff's deputies stationed in Williams, a DPS officer stationed in Tusayan, and Forest Service and NPS law enforcement personnel).

**Medical Facility**

Under Alternative G, improved land or office space would be made available for sale or lease by CFV to a primary health care provider for operation of a health

clinic, an emergency air evacuation system and other specialized care providers. Medical facilities provided in the CFV development would help to ensure that the medical services and facilities in Grand Canyon would not be used beyond capacity. If additional medical facilities are not provided, the medical services and facilities within GCNP could be used beyond capacity.

**Sewage**
A new conventional wastewater treatment plant would be constructed under this alternative. The sludge by-product generated by this system would be disposed of in a designated site approved for this use. The size of the system would depend on whether the Forest Service and Moqui Lodge (which currently operates a separate system), would be interested in participating in the construction of a new system. If either or both participate, the parties would decide on the financing structure, and an appropriate-sized facility would be constructed. In the conventional treatment process, ultraviolet multi-media filters and disinfectants would process wastewater prior to removal of filtered nutrients (nitrates and phosphates). Reclaimed water would be held in storage tanks or ponds and used for toilets in dual-plumbed facilities (the transit center, and all residences and visitor lodging facilities), landscape irrigation, and fire suppression.

The transit center would generate an estimated 70,000 gallons per day of wastewater. If the transit center is developed prior to CFV, the wastewater generated at the transit center would be transferred to the SGCSD treatment plant through six-inch to ten-inch diameter pipes, requiring installation of an estimated one-half to one mile of pipeline. This facility was recently expanded and currently, can accommodate the additional volume produced by the transit center before reaching capacity. The transit center could connect to the CFV wastewater treatment facility after it is completed.

**Solid Waste**
Using the EPA average waste generation of four pounds per person per day, approximately 9,000 pounds of waste would be generated daily by the CFV development. Considering the size and capacity of the Grand Canyon Transit Center, approximately 16,000 pounds of waste would be generated daily at the transit center. Solid waste would be reduced through the collection of recyclable materials at the transit center and businesses in the village core, and curb-side recycling in residential areas.

Solid waste would be hauled directly from CFV to the city landfill northeast of Flagstaff, by-passing the Tusayan transfer station, unless a regional solid waste facility is established closer to Tusayan in the future.

**Tax Revenue**
Alternative G would generate additional tax revenue for the State of Arizona and Coconino County. The state assesses a 5% sales tax while the county assesses a 0.5% sales tax. The development would also generate personal and corporate income taxes and business property taxes. Additional property tax revenues would accrue to the Grand Canyon School District, the Tusayan Fire District, Coconino County, and the Community College. Property tax revenues would exceed what is currently collected from the CFV-controlled private inholdings.

The population that would result from this level of development could allow for incorporation of Tusayan. Incorporation would allow the municipality to tax residence, business, and property owners within the incorporated area.

### Cumulative Impacts
Redevelopment of Tusayan would create additional solid waste that would be hauled to the county transfer station, then to the Flagstaff city landfill. Potential cumulative impacts to the landfill could occur if other municipalities in Coconino County decide to transport their solid waste to Flagstaff as well. The need for funding to further expand the landfill may require raising tipping fees and costs charged to residents of Flagstaff and Coconino County. Cumulatively, tax revenues are expected to increase with implementation of Alternative G and continued growth and redevelopment in Tusayan, Valle, and other communities in northern Arizona as visitation to GCNP continues to grow.

## Alterative H
### Direct and Indirect Impacts
**Community Services and Facilities**

Table 4.31 shows the community services and facilities that could be provided in Alternative H and how they would be financed. Under this alternative, CFV would build a 4,000 square foot community center available to all area residents; donate 21 acres of improved land for a school to the local school district; and construct, equip, and donate a police and fire station to the Coconino County and the Tusayan Fire District. Additional improved land or building space would be sold or leased at market rate to users for community facilities such as a cemetery, medical clinic, library, and houses of worship. CFV would build playgrounds and gathering areas within the residential areas that would be available for all area residents. Local governmental entities would be responsible for raising the funds necessary to lease or purchase the improved land, and construct and equip the community facilities. Currently, there is not a local governing body for Tusayan. With the development of CFV, the overall population of Tusayan may allow for incorporation. The incorporation of Tusayan would provide additional opportunities for financing the community facilities.

**Table 4.31 Disposition of Community Services and Facilities in Alternative H**

| | Land Area | | Infrastructure[1] | | Building | |
|---|---|---|---|---|---|---|
| Community Service or Facility | Contributed | Sold or Leased to User | Contributed | Paid for by User | Contributed | Paid for by User |
| School | X | | X | | | X |
| Police Station | X | | X | | X | |
| Fire Station | X | | X | | X | |
| Community Center | X | | X | | X | |
| Medical Clinic | | X | X | | | X |
| Library | | X | X | | | X |
| Post Office | | X | X | | | X |
| Parks | X | | X | | X | |
| House(s) of Worship | | X | X | | | X |
| Cemetery | | X | X | | | X |

1. Basic infrastructure (access and utility hook-up) would be provided by CFV. A portion of these costs would be recouped through lease rates.

**Police and Fire Protection**

CFV would construct, equip, and donate a police and fire station to Coconino County and the Tusayan Fire District. This would alleviate pressure on the KNF and NPS who cooperatively provide fire protection in the Grand Canyon/Tusayan area. CFV would also construct, equip, and donate a sheriff's substation to the county. The provision of fire and police facilities in the CFV development would reduce response times in Tusayan.

**Medical Facility**

Under Alternative G, improved land or office space would be made available for sale or lease by CFV to a primary health care provider for operation of a health clinic, an emergency air evacuation system and other specialized care providers. Medical facilities provided in the CFV development would help to ensure that the medical services and facilities in Grand Canyon would not be used beyond capacity. If additional medical facilities are not provided, the medical services and facilities within GCNP could be used to or beyond capacity.

**Sewage**

A new wastewater treatment and disposal facility would be constructed using the Solar Aquatics System (SAS). This system consists of greenhouses with solar ponds and vegetation beds that treat effluent for subsequent discharge to composting reed beds and infiltration basins. No chemical are used in the SAS process and no sludge is produced as a by-product.

Reclaimed wastewater produced by the SAS may be 1) discharged to natural or man-made ponds, 2) used for landscape irrigation, 3) used for toilets in dual-plumbed facilities, or 4) processed through a treatment facility using reverse osmosis for re-use as potable water. Use of reclaimed wastewater for potable and nonpotable purposes would require review and approval by ADEQ and ADWR. The construction of an SAS facility would have no impact on existing wastewater treatment facilities, and would serve as an option for the Forest Service and Moqui Lodge (which currently operates a separate system).

The transit center would generate an estimated 70,000 gallons per day of wastewater. Initially, this wastewater would be transferred to the SGCSD wastewater treatment plant via pipeline, requiring installation of an estimated one-half to one mile of pipe. This facility was recently expanded, and currently, could accommodate the additional volume of wastewater produced by the proposed transit center. The transit center could hook-up to the SAS when constructed by CFV.

**Solid Waste**
Using the EPA average waste generation of four pounds per person per day, approximately 15,000 pounds of waste could be generated daily by the CFV development. Considering the size and capacity of the Grand Canyon Transit Center, approximately 16,000 pounds of waste would be generated daily at the transit center. Solid waste generated from the transit center would be reduced through the collection of recyclable materials. Under Alternative H, CFV has committed to reduce waste generated from the development by 75%. This would be accomplished through extensive recycling of materials, operating a composting system, and recycling construction waste. This program would reduce the amount of on-site waste generated daily by the CFV development to 4,000 pounds.

Construction materials make up a significant portion of landfill volume (20-30%). Possibilities include recovering wood and stone for reuse at another site, recycling metals to generate other materials, crushing glass for use in paving material and other applications, crushing concrete for use as an aggregate in new concrete, and grinding up gypsum wall product for use as an agricultural soil additive.

Solid waste would be hauled directly from CFV to the city landfill northeast of Flagstaff, by-passing the Tusayan transfer station, unless a regional solid waste facility is established closer to Tusayan in the future.

**Tax Revenue**
Alternative H would generate additional tax revenue for the State of Arizona and Coconino County. The state assesses a 5% sales tax while the county assesses a 0.5% sales tax. The development would also generate personal and corporate income taxes and business property taxes. Additional property tax revenues would accrue to the Grand Canyon School District, the Tusayan Fire District, Coconino County, and the Community College. Property tax revenues would exceed what is currently collected from the CFV-controlled private inholdings.

The population that would result from this level of development could allow for incorporation of Tusayan. Incorporation would allow the municipality to tax residence, business, and property owners within the incorporated area.

### Cumulative Impacts
Cumulative impacts under Alternative H are the same as those described under Alternative G.

## Visitor Experience in and Around Grand Canyon

Environmental consequences associated with this resource are divided into seven categories: Grand Canyon experience, visual quality, air quality, light pollution, noise pollution, GCNP management, and GCNP visitation.

### Grand Canyon Experience

**Issue:** Development of private or NFS land near Tusayan could affect some of the values of GCNP and the surrounding KNF through increased visitation and impaired or degraded quality of the visitor experience resulting from further urbanization near the park boundary.

### Methods for Analyzing Impacts
No new methods are proposed.

### Alternative F

#### Direct and Indirect Impacts

Under this alternative, a transit center would be constructed north and adjacent to Tusayan, and most of Grand Canyon Village would be closed to vehicular traffic. Instead of driving up to the park and looking for a parking space at Grand Canyon Village or one of the overlooks, visitors would enter into a large parking lot just north of Tusayan where they would park their cars. Visitors would then proceed to the transit center where they would be able to obtain information about overnight accommodations in the Grand Canyon/ Tusayan area and outlying communities, obtain backcountry information, obtain information about regional attractions, and learn about the GCNP transit system and attractions in the park. Park entrance and transit system tickets would be purchased at the transit center as well. Limited commercial development would be provided at the transit center. The 2,000 square feet of retail at the transit center would be oriented to basic visitor necessities.

Visitors ready to go into GCNP would board the light rail system for the ride into the park. Within the park, they would use the expanded shuttle system or hiking and biking trails to move from one area to another. When visitors decide to leave, they would take the light rail system back to the Grand Canyon Transit Center, north of Tusayan.

#### Cumulative Impacts

Redevelopment of commercial properties in Tusayan would serve to increase the amount and variety of visitor services and facilities near the Grand Canyon Transit Center. The IMAX theater would be adjacent to the parking area and within walking distance along a pedestrian walkway linking Tusayan with the transit center. Visitors staying in Tusayan may use the transit system multiple times in one day for access into the park.

Development of several of the CFV-controlled private inholdings would also serve to increase the amount and variety of visitor services and facilities in the area. With development of the Ten-X, Kotzin, and Lower Basin private inholdings, development would not be concentrated around Tusayan, but would be dispersed in pockets within the Tusayan Ranger District. While dispersed pockets of development could allow the visitor exposure to a variety of landscape settings, the visitors would be required to travel more distance.

Tusayan redevelopment, together with the development of CFV, would increase the average length of stay for visitors to the area, but not necessarily for the period of time spent in the park. Visitors may elect to make northern Arizona a trip destination in itself rather than a stopover on a more extensive trip itinerary as other opportunities are developed at and adjacent to GCNP that keep people in the area longer. Additional educational and recreational opportunities in the Grand Canyon/ Tusayan area may also affect the rate of visitation to the area, particularly for in-state and northern Arizona residents, who may choose to visit Grand Canyon more frequently. However, the collective amount of development that could occur in the Grand Canyon area may deter others from visiting GCNP.

### Alternative G

#### Direct and Indirect Impacts

The basic arrival sequence for visitors under Alternative G would be similar to Alternative F. Upon parking their vehicle, visitors would proceed to the transit center where they would purchase their park entrance and transit ticket and obtain information about the park, Grand Canyon/Tusayan area, and regional attractions. If visitors choose to not go immediately into the park using the mass transit system, they would have access to a variety of visitor services and facilities adjacent to the transit center and parking lot in the CFV development. INSIGHT, the proposed educational facility, and the CFV Village Core would be within walking distance of the transit center. A description of INSIGHT and the CFV Village Core is provided in chapter 2.

Upon returning to the Grand Canyon Transit Center after visiting the park, visitors could go to their vehicles and leave the area, or they could use the facilities at CFV. Visitors staying in CFV lodging accommodations may use the mass transit system multiple times in one day for access into the park.

Some visitors may extend their stay because of the range of facilities and educational opportunities available within CFV.

### Cumulative Impacts

Development of commercial properties in Tusayan would also serve to increase the amount and variety of visitor services and facilities near the Grand Canyon Transit Center. The IMAX theater would be adjacent to the parking area and within walking distance along a pedestrian walkway linking Tusayan with the transit center and CFV Village Core. Visitors staying in Tusayan may use the transit system multiple times in one day for access into the park. Tusayan redevelopment, together with the development of CFV, would increase the average length of stay for visitors to the area.

Visitors may elect to make northern Arizona a trip destination in itself rather than a stopover on a more extensive trip itinerary as other opportunities are developed at and adjacent to GCNP that keep people in the area longer. Additional educational and recreational opportunities in the Grand Canyon/ Tusayan area may also affect the rate of visitation to the area, particularly for in-state and northern Arizona residents, who may choose to visit Grand Canyon more frequently. However, the collective amount of development that could occur in the Grand Canyon area may deter others from visiting GCNP.

## Alternative H

### Direct and Indirect Impacts

Impacts to the visitor experience under this alternative are similar to those under Alternative G; however, Alternative H offers additional opportunities for visitors to the CFV development. The creation of a Native American Marketplace would provide visitors the opportunity to purchase cultural wares and traditional foods of Colorado Plateau Indian Tribes. The sustainable elements of Alternative H would provide additional educational opportunities for visitors. In the CFV development, visitors would see and experience sustainable design practices and how they can conserve resources and protect the environment.

### Cumulative Impacts

The cumulative effects of Alternative H would be the same as described under Alternative G.

# Visual Quality

**Issue:** The level of proposed development in the Tusayan area along State Highway 64 may increase, altering visual conditions along the highway. The development of the private inholdings represents a change in the landscape that may be visible to KNF and GCNP visitors.

## Methods for Analysis

No new methods are proposed.

## Alternative F

### Direct and Indirect Impacts

Under Alternative F, approximately 110 acres of NFS land would be developed. The project as currently conceived would employ best design and management practices (BDMP) to minimize impacts to visual resources. Overall, the visual character of Tusayan would not likely be diminished. Measures beyond those in the Tusayan Area Plan would not be enforceable on the federal land acquired under the Townsite Act for the community facilities, but additional measures to minimize visual quality impacts would be implemented on the NFS land used for federal employee housing and the transit center. Both components would adopt the Grand Canyon National Park Architectural Guidelines. Undeveloped NFS land would remain to the west and north of the proposed development, and between the transit center and the federal housing/community facilities. This would serve to maintain the natural setting of the area. Figure 4.9 illustrates the entry to the transit center from State Highway 64.

State Highway 64 is the only identified sensitive viewpoint from which the development proposed in Alternative F could be viewed. Because of the elevated topography of the Grand Canyon Transit Center parking lot, only a portion of the lot would be visible to travelers heading north on State Highway 64 from Tusayan. Although the development of the transit center parking lot would alter the existing landscape setting, some visibility of this facility would help orient GCNP visitors arriving to the area.

Figure 4.9 Artist's Rendering of Entry to Grand Canyon Transit Center in Alternative F

### Cumulative Impacts

Development in the region would be dispersed over several areas with the development of the TenX, Lower Basin, and Kotzin private inholdings. Although development of these private inholdings would require approvals, permits, and licenses from Coconino County, there are minimal regulatory means to ensure that BDMP's would be applied to the development of the private inholdings. The Tusayan Area Plan would apply to TenX and Kotzin, while the Coconino County Comprehensive Plan would govern development of the Lower Basin private inholding. Approximately 194 acres could be developed on the TenX inholding, which would negatively affect visual quality of the landscape viewed from Forest Road 302. Approximately 160 acres could be developed on the Kotzin private inholding. Although development of this area would change the visual quality of adjacent NFS land, it would not be visible from the identified sensitive viewpoints, with the exception of air tours. Approximately 320 acres could be developed on the Lower Basin private inholding, that is immediately adjacent to State Highway 64. Visitors to GCNP using the east entrance would have extensive views of the development on Lower Basin from a three-mile segment of State Highway 64 and from portions of East Rim Drive within GCNP.

The redevelopment of Tusayan would occur within the private property limits in Tusayan and would alter the appearance of Tusayan. It is likely that redevelopment would result in higher densities of commercial development than what currently exists, particularly for the portion of Tusayan east of State Highway 64.

## Alternative G

### Direct and Indirect Impacts

Under Alternative G, CFV would use BDMP's and would adopt the Grand Canyon National Park Architectural Guidelines to minimize disturbance and visual impacts. Because of the intent to keep all services and facilities within reasonable walking distance of each other, the development would have an urban appearance when viewed from the CFV Village Core and residential areas. Natural materials like stone and wood would be used to the extent practicable, and within economic constraints. Natural areas and native landscaping would be integrated throughout the development to improve the overall appearance of the development. Dedicated open space accounts for 26% of the total land allocation. Open areas would be used to define community boundaries, protect sensitive topography and features, and separate uses within the development. The entry to CFV from State Highway 64 would be similar in appearance to the design for Alternatives B and C. This is displayed in Figure 4.10.

State Highway 64 is the only identified sensitive viewpoint from which the development proposed in Alternative G could be viewed. Because of the elevated topography of the Grand Canyon Transit Center parking lot, only a portion of the lot would be visible to travelers heading north on State Highway 64 from Tusayan. Although the development of the transit center parking lot would alter the existing landscape setting, some visibility of this facility would help orient GCNP visitors arriving to the area.

The transit center, like the CFV development, would employ BDMP's and the Grand Canyon National Park Architectural Guidelines to minimize visual impacts to the area. Overall, the visual character of Tusayan would not likely be diminished. Portions of the Grand Canyon Transit Center and CFV development would be visible from the north end of Tusayan.

### Cumulative Impacts

Cumulative impacts would include redevelopment of portions of Tusayan. As part of redevelopment, GCIA is working with ADOT to landscape the State Highway 64 right-of-way as it passes through Tusayan.

Figure 4.10 Artist's Rendering of Entry to CFV as Viewed from State Highway 64 in Alternatives G and H

### Alternative H

#### Direct and Indirect Impacts

Visual impacts under Alternative H would be similar to those described under Alternative G. CFV would use BDMP's and the Grand Canyon National Park Architectural Guidelines, and follow the concepts of sustainable design, incorporating aesthetics as an important design consideration. Although the footprint of this development is essentially identical to Alternative G, this alternative proposes the construction of additional lodging, retail, and residential areas within the development footprint; therefore, the overall appearance of the CFV development may appear more urbanized than under Alternative G when viewed from the CFV Village Core and residential area. The design concept for this alternative uses architectural styles and construction materials that would help reduce impacts. Dedicated open space accounts for 26% of the total land allocation, and additional open areas, trails, and natural landscaping are integrated into areas of the development to improve the overall appearance of the development. The entry to CFV from State Highway 64 would be similar in appearance to the design for Alternatives B, C, and G (see Figure 4.10).

State Highway 64 is the only identified sensitive viewpoint from which the development proposed in Alternative H could be viewed. Because of the elevated topography of the Grand Canyon Transit Center parking lot, only a portion of the lot would be visible to travelers heading north on State Highway 64 from Tusayan. Although the development of the transit center parking lot would alter the existing landscape setting, some visibility of this facility would help orient GCNP visitors arriving to the area.

The transit center, like the CFV development, would employ BDMP's and the Grand Canyon National Park Architectural Guidelines to minimize visual impacts to the area. Overall, the visual character of Tusayan would not likely be diminished. Portions of the Grand Canyon Transit Center and CFV development would be visible from the north end of Tusayan.

#### Cumulative Impacts

Impacts would be similar to those described under Alternative G.

## Air Quality

**Issue:** Additional development of private or NFS lands near Tusayan could result in a change in vehicle-emitted air pollution and overall visibility in Grand Canyon.

### Methods for Analysis

No new methods are proposed.

### Alternative F

#### Direct and Indirect Impacts

Under this alternative, development on the NFS land developed for community and transportation purposes would be required to comply with the stringent standards of a Class I airshed under the Clean Air Act in addition to the National Ambient Air Quality Standards established by the EPA. A reduction in air quality from dust and vehicle exhaust would be expected during construction activities associated with development. These impacts, however, would be localized and temporary. Mitigation measures designed to minimize air quality impacts would be required for the development of the federal housing complex and transit center on federal land.

By restricting the use of private vehicles in the park and implementing a mass transit system, emissions generated from vehicle exhaust would be reduced in the park, improving long-term air quality in the park.

#### Cumulative Impacts

Development of the private inholdings would change local vehicle traffic in the Tusayan area, as increased numbers of vehicles would be traveling between the private inholdings and the transit center. If the Lower Basin private inholding is developed, additional traffic between Desert View and Tusayan would result, increasing vehicle emissions in the park. If secondary transportation staging areas are developed in the outlying communities as proposed in the Regional Transportation Plan coordinated by NACOG, these staging areas would reduce reliance on private vehicles traveling to GCNP, resulting in fewer vehicle emissions on a regional basis from visitation associated with GCNP.

### Alternative G

#### Direct and Indirect Impacts

Development under this alternative would be concentrated in the Tusayan area. Decreases in air quality from dust and vehicle exhaust would be expected during construction activities associated with development of CFV and the Grand Canyon Transit Center. These impacts are expected to be localized and temporary.

Although visitation to the park is expected to increase over the planning period for this EIS, regional air quality should improve. Restricting the use of private vehicles in the park and implementing a mass transit system would reduce emissions from vehicle exhaust in the park. The philosophy and design of this alternative is to encourage visitors to leave their vehicles at the transit center. Visitor services and facilities in CFV would be within walking distance of the parking area.

#### Cumulative Impacts

Visitors staying in Tusayan could access the Grand Canyon Transit Center and CFV development along a pedestrian walkway. This would serve to reduce the overall use of private vehicles in the Tusayan area. If secondary transportation staging areas are developed in the outlying communities as proposed in the Regional Transportation Plan coordinated by NACOG, these staging areas would further reduce reliance on private vehicles to reach GCNP, and thus reduce vehicle emissions on a regional basis.

### Alternative H

#### Direct and Indirect Impacts

Impacts to air quality under Alternative H would be the same as those described under Alternative G.

#### Cumulative Impacts

Impacts to air quality under Alternative H would be the same as those described under Alternative G.

## Light Pollution

**Issue:** Commercial and community growth in the Tusayan area may create additional light pollution for visitors looking across Grand Canyon from the North Rim and for backcountry users in GCNP. Such growth could also diminish night-sky visibility for visitors and residents in GCNP, KNF, and Tusayan.

### Methods for Analysis

No new methods are proposed.

### Alternative F

#### Direct and Indirect Impacts

Standards established by the International Dark Sky Association indicate that an increase in lighting to at least 20% above natural background light would affect the night-sky viewing with the naked eye. An increase of 10% above natural background light would affect the viewing of stars with a powerful telescope.

Based on the limited amount of development proposed in Alternative F, night sky glow would not increase noticeably over existing background night sky light levels at GCNP overlooks.

#### Cumulative Impacts

Development of additional private inholdings, plus existing and planned development in Tusayan, would disperse light pollution over a broad area, increasing the impact to GCNP viewpoints.

### Alternative G

#### Direct and Indirect Impacts

Minimum outdoor lighting would be installed to comply with the provisions of Zone 3 of the Coconino County Lighting Code. Table 4.31 shows the percentage increase in night-time sky glow above the existing background at the North Rim, Mather Point, and Desert View from the CFV development under Alterative G. Increased ambient night-sky glow levels at the North Rim would increase 0.7% over existing conditions, but this impact may be more noticeable because the North Rim is approximately 1,000 feet higher in elevation than the South Rim. Impacts of greater than 20% would be noticeable with the naked eye up to 6.5 miles from the development.

**Table 4.31 Increase in Night-time Sky Glow above Existing Conditions in Alternative G**

| Location | Increase in Sky Glow (percent) |
|---|---|
| North Rim | 0.7 |
| Mather Point | 8.2 |
| Desert View | 0.5 |

### Cumulative Impacts

Redevelopment of portions of Tusayan would contribute to an increase in night lighting in the Tusayan area. The collective amount of development could increase background night sky glow by more than 20% up to 8.6 miles from Tusayan, thus impacting the night-time view from several overlooks on the South Rim.

### Alternative H

### Direct and Indirect Impacts

Minimum outdoor lighting, sky-shields, and low-level fixtures would be installed in the CFV development under Alternative H to comply with the provisions of Zone 2 of the Coconino County Lighting Code. This code limits night-time lighting to 50,000 lumens per acre, half of the limit of Zone 3, the current code in Tusayan. Table 4.25 shows the percentage increase in night-time sky glow above the existing background at the North Rim, Mather Point, and Desert View from the CFV development under Alternative H. Increased ambient night-sky glow levels at the North Rim would increase 0.5% over existing conditions, but this impact may be more noticeable because the North Rim is approximately 1,000 feet higher in elevation than the South Rim. Impacts of greater than 20% would be noticeable with the naked eye up to 6.0 miles from the development.

**Table 4.32 Increase in Night-time Sky Glow above Existing Conditions in Alternative H**

| Location | Increase in Sky Glow (percent) |
|---|---|
| North Rim | 0.5 |
| Mather Point | 6.6 |
| Desert View | 0.4 |

### Cumulative Impacts

Redevelopment of portions of Tusayan would contribute to an increase in night lighting in the Tusayan area. The collective amount of development could increase background night sky glow by more than 20% up to 8.3 miles from Tusayan, thus impacting the night-time view from several overlooks on the South Rim.

## Noise

**Issue:** Additional development of private or NFS land near Tusayan may increase noise associated with residential use, local traffic, mass transit, and air traffic in the Tusayan and Grand Canyon village areas.

### Methods for Analysis

No new methods are proposed.

### Alternative F

### Direct and Indirect Impacts

Under Alternative F, it is unlikely that the railway spurline would be built because of competition from the proposed mass transit system at the Grand Canyon Transit Center. The light-rail system, chosen by the NPS for the mass transit system, would contribute very little to the existing ambient noise levels. However, short-term noise impacts would occur from construction of the Grand Canyon Transit Center, and the federal housing and community facilities.

Airport operations would not be affected under Alternative F. Approximately 42 acres at the southern end of Tusayan would receive noise levels above 65 decibels from the airport by the year 2010 from the addition of a second runway. Noise-level guidelines developed by the Federal Aviation Administration, Department of Housing and Urban Development, and others have placed no restrictions on land use for areas receiving less than a Day-Night Average Sound Level of 65 decibels. For lands receiving greater than 65 decibels, incompatible land uses include residential, visitor lodging, schools, hospitals, nursing homes, churches, auditoriums, and concert halls. No new

development would be planned within the 65-decibel contour under this alternative.

### Cumulative Impacts

Development could potentially occur on the private inholdings, including Lower Basin, which could eventually become a gateway development for the east entrance to the park. As no mass transit or staging area is proposed for this area, visitors would rely on private vehicles for transportation into the eastern portion of the park, with a likely increase in visitor traffic at Desert View, and a corresponding increase in noise. Other portions of the South Rim would be closed to private vehicle use, reducing noise levels in these areas. Visitors from the Lower Basin development wishing to access other portions of the park would need to drive from Desert View to Tusayan and use the mass transit system. Development of the TenX and Kotzin inholdings would increase local traffic resulting in increased noise levels in the Tusayan area.

The collective amount of development in the area from redevelopment of Tusayan and development of several CFV-controlled private inholdings may accelerate the addition of a second runway at Grand Canyon Airport. This would allow for greater air traffic in the Tusayan area and would increase aircraft noise in the area.

## Alternative G

### Direct and Indirect Impacts

It is also unlikely that the railway spurline would be built under Alternative G. Noise impacts related to construction and operation of the Grand Canyon Transit Center under Alternative G would be the same as described under Alternative F.

Short-term impacts from construction activities associated with development of CFV would be expected. Noise impacts from construction would be greatest over the first few years of operation but would not be continuous as construction would generally be limited to daylight hours.

### Cumulative Impacts

Continued population growth in the Tusayan area from the development of CFV and the redevelopment of Tusayan would increase urban noise associated with increased visitor use and increased resident population.

Noise impacts from aircraft operations under Alternative G would be the same as described under Alternative F.

## Alternative H

### Direct and Indirect Impacts

Direct and indirect impacts to noise under Alternative H would be the same as described under Alternative G.

### Cumulative Impacts

Cumulative impacts to noise under Alternative H would be the same as described under Alternative G.

# Grand Canyon National Park Management

**Issue:** Development of private or NFS land near Tusayan could affect management of GCNP. Management of park visitation may improve with additional visitor-related facilities and services constructed outside the park.

## Methods for Analysis

No new methods are proposed.

## Alternative F

### Direct and Indirect Impacts

**Visitor Facilities**

Under Alternative F, the Grand Canyon Transit Center would provide the visitor with information about GCNP, KNF, Tusayan, regional attractions, and visitor accommodations. Only limited visitor retail facilities would be provided at the transit center. The 2,000 square feet of retail would be oriented to visitor necessities (e.g., film, prepared food items, bottled water).

**Traffic**

Under this alternative, a transit center would be constructed north and adjacent to Tusayan. The transit center parking lot could accommodate up to 3,500 vehicles, which is consistent with the needs expressed in the GCNP GMP. Additional NFS land would be available for phase II parking if needed.

Increased use of the mass transit system would be expected from residents living in GCNP and using residential facilities and community services outside the park.

**Housing and Community Facilities**
The GCNP GMP identifies a need for up to 500 housing units to be built outside the park. Under this alternative, the KNF would dedicate land for housing for federal employees. Park concessionaire employees would not obtain housing on NFS land under this alternative. Like other employees of Tusayan, they would need to find housing in Tusayan, Valle, or in other nearby communities. GCNP has proposed a total of 100 housing units in a mixture of duplex, dormitory, and apartment styles. If housing is privately developed, rental rates would be subject to market pricing. Current rates range from $650/month for a two-bedroom apartment to $450/month for a one-bedroom apartment. If housing is federally-funded, rents would be determined using a government-established formula, as they currently are for park employees.

The Forest Service would make land available for purchase under the Townsite Act to governmental entities such as the Grand Canyon School District for a new school, a governmental entity to build a community hall, and the Tusayan Fire District to build a fire station. Funding for the purchase of NFS land at market value, construction of the infrastructure, and construction of these facilities has not been determined. If these facilities are not constructed, the community facilities in GCNP would continue to serve the growing resident population in Tusayan and GCNP. These facilities are currently used at or near capacity.

### Cumulative Impacts
The redevelopment of Tusayan, and potential development of the TenX and Kotzin private inholdings would increase the amount and mix of facilities available for GCNP visitors outside park boundaries, which is consistent with the intent of the GCNP GMP. Development of housing at TenX and Kotzin could potentially accommodate the housing needs expressed in the GCNP GMP.

Development of the Lower Basin private inholding could create changes in visitor use and traffic patterns that are not consistent with the management direction in the GCNP GMP. The increase in visitation at the east entrance that could occur from development of Lower Basin could overburden facilities at Desert View.

## Alternative G
### Direct and Indirect Impacts
**Visitor Facilities**
This alternative would meet the intent of the park's GMP by accommodating visitor facility needs outside the park in a consolidated area in Tusayan, and by providing the visitor with orientation information at the transit center and educational and interpretive opportunities at INSIGHT. In addition to a mix of lodging, retail, and food and beverage development, Alternative G provides for the development of a 27-acre INSIGHT facility, envisioned as a multipurpose, multi-audience experiential/educational center that would serve visitors to GCNP and provide information about regional attractions.

**Traffic**
The Grand Canyon Transit Center would be constructed north and adjacent to Tusayan. The transit center would include 35 acres for phase I parking, and another 30 acres of parking when CFV is developed. This plan is consistent with the direction of the GCNP GMP. Federal acquisition of the private inholdings would preclude development of the Lower Basin private inholding. Current visitor patterns would be expected to remain unchanged, with 75% of all South Rim visitors accessing the park through Tusayan and 25% through Desert View (GCNP 1997 data).

**Housing and Community Facilities**
CFV would initially provide 50 trailer/manufactured home pads for lease to area residents at market rates and lease 20 acres of improved land for NPS, other federal, and park concessionaire employee housing. This amount of land could accommodate the 500 units of housing called for in the GCNP GMP.

Improved land or building space would be provided for lease or sale at market rate by CFV for a mix of community facilities. Community facilities would

include a library, post office, cemetery, medical clinic, police/fire station, and houses of worship. A 21-acre improved land area would be donated to the Grand Canyon School District for a school. Additionally, a 4,000 square foot community center would be constructed and managed by CFV for all area residents.

This would relieve pressure on community facilities in the park that are currently operating at or near capacity.

#### Cumulative Impacts
Redevelopment of Tusayan would increase the amount and mix of facilities available for GCNP visitors outside park boundaries, which is consistent with the intent of the GCNP GMP.

### Alternative H
#### Direct and Indirect Impacts
Direct and indirect impacts would be similar to those described under Alternative G with several distinctions. CFV would construct, equip, and donate a police and fire station to the county and Tusayan Fire District. Instead of leasing 50 trailer/manufactured home pads, CFV would initially provide 50 townhomes and garden homes for sale or lease to area residents at market or subsidized rates.

#### Cumulative Impacts
Cumulative impacts under Alternative H would be the same as described under Alternative G.

## Grand Canyon National Park Visitation

**Issue:** Development of visitor facilities near Tusayan could alleviate excess demand for lodging and food services in GCNP. However, average visitor length of stay may increase, affecting park facilities, services, and resources.

### Methods for Analysis
No new methods are proposed.

### Alternative F
#### Direct and Indirect Impacts
Under this alternative, no visitor guest lodging and only 2,000 square feet of retail and food and beverage services would be constructed in association with the transit center. The length of visitor stay in GCNP would not be expected to change substantially from development of the transit center. Some visitors may use the mass transit system for multiple trips to the park in the same day.

#### Cumulative Impacts
Redevelopment of Tusayan would be expected, along with the potential development of the Kotzin and TenX inholdings, which would offer additional visitor services and facilities in the Tusayan area. The addition of these visitor services and facilities would likely increase the length of visitor stay in the Grand Canyon/Tusayan area.

Development of visitor facilities on the Lower Basin inholding would be expected to draw a number of visitors from the south entrance to the east entrance area, changing visitation patterns on the South Rim. These visitors would continue to access the park in their private vehicles which could lead to overcrowding at parking areas and vista points along East Rim Drive, further degrading park resources. Tourists wishing to visit other areas of the park, including Grand Canyon Village, would drive from Desert View to the Grand Canyon Transit Center in Tusayan, and use the mass transit system. While these visitors may choose to stay longer at Lower Basin if this area were to be developed, they would not be expected to stay longer in the park, nor would they be expected to make multiple trips into the park.

### Alternative G
#### Direct and Indirect Impacts
The CFV development and Grand Canyon Transit Center would offer a full range of visitor services and facilities for the increasing numbers of people expected to visit the park. The transit center would be constructed immediately adjacent to CFV, and with expansion of the phase II parking, would be able to accommodate peak season visitor forecasts through 2010. Although the length of visitor stay in GCNP is not expected to change substantially, the length of visitor stay in the Grand Canyon/Tusayan area would likely increase, and visitors may make multiple trips into the park. It is also possible that visitation would be more evenly distributed over the course of the day,

relieving pressures on park facilities. Limiting the use of private vehicles in GCNP would lessen visitor impacts on park resources and allow for more efficient and effective management of those resources.

### Cumulative Impacts

Redevelopment of Tusayan would be expected under this alternative, which would provide additional visitor services and facilities outside the park. Under this alternative, the park would be able to accommodate the level of visitation forecast for the early part of the next century and ensure that the bulk of the facilities needed by visitors would be provided outside park boundaries.

## Alternative H

### Direct and Indirect Impacts

Direct and indirect impacts to GCNP management under Alternative H would be the same as described under Alternative G.

### Cumulative Impacts

Cumulative impacts to GCNP management under Alternative H would be the same as described under Alternative G.

# Transportation

**Issue:** A transit center near Tusayan could relieve traffic congestion in GCNP by providing a staging area for alternative transportation modes into the park. As park visitation continues to increase, traffic congestion in the Tusayan area and on State Highway 64 could increase as well.

Further development in the Tusayan area could result in greater use of Grand Canyon Airport runway and its facilities. Expansion of the community in the general vicinity of the airport may increase land-use conflicts and affect public safety.

## Methods for Analysis

No new methods are proposed.

## Alternative F

### Direct and Indirect Impacts

Under Alternative F, a transit center would be built on NFS land under special use permit north and adjacent to Tusayan that could accommodate visitation projections estimated in the GCNP GMP through the year 2010. Visitors would leave their vehicles at the transit center and take a light rail system into the park. This plan would alleviate much of the traffic congestion and parking problems in Grand Canyon Village. Restricting use of private vehicles in the park would allow roads to operate below capacity, at a level-of-service classification of "B" or better. Park shuttles would therefore be more reliable because of decreased local traffic in GCNP.

Traffic control changes would be made on State Highway 64 by the transit provider to direct traffic flow into the transit center parking lot. Eventually, pending ADOT approval, State Highway 64 would be realigned to terminate in the transit center parking lot.

### Cumulative Impacts

Redevelopment of Tusayan and potential development of several private inholdings controlled by CFV would increase the number of residents and visitors in the area resulting in additional traffic on forest roads accessing the private inholdings.

Development of Lower Basin could change current traffic patterns by increasing the number of visitors that enter and exit the park at the east entrance. An increase in vehicle traffic would be expected on U.S. Highway 89 and on State Highway 64, between Tusayan and Desert View. Tourists staying at Lower Basin would drive from Desert View to the Grand Canyon Transit Center, and would use the mass transit system to visit other areas of the park, including Grand Canyon Village. CFV would be responsible for constructing necessary road access improvements at the intersection of Lower Basin and State Highway 64.

If secondary transportation staging areas are developed in the outlying communities as proposed in the Regional Transportation Plan coordinated by NACOG, these staging areas would further reduce reliance on private vehicles to access the Grand Canyon/Tusayan area.

### Alternative G

#### Direct and Indirect Impacts

Impacts to transportation under Alternative G would be similar to those described under Alternative F.

#### Cumulative Impacts

Redevelopment of Tusayan would lead to higher visitor use of the area and additional traffic on the roads in Tusayan. This may necessitate improvements such as signals to State Highway 64, as it passes through Tusayan, to allow traffic to operate more efficiently. Traffic in the park would not be expected to change from the collective impact of the redevelopment of Tusayan.

If secondary transportation staging areas are developed in the outlying communities as proposed in the Regional Transportation Plan coordinated by NACOG, these staging areas would further reduce reliance on private vehicles to enter GCNP.

### Alternative H

#### Direct and Indirect Impacts

Impacts to transportation under Alternative H would be similar to those described under Alternative F.

#### Cumulative Impacts

Cumulative impacts to transportation under Alternative H would be the same as described under Alternative G.

## Development Plan Assurances

> **Issue:** Development of private or NFS land near Tusayan would require a specific plan that includes assurances that what is proposed and analyzed for development would actually be built and that development and mitigation commitments would be carried out during implementation.

### Methods for Analysis

No new methods are proposed.

### Alternative F

#### Direct and Indirect Impacts

Activities on the 40 acres of NFS land acquired through the Townsite Act would be subject to statutory requirements limiting the use of this land to community and noncommercial purposes. The local governmental entities that purchase land from the Forest Service for community purposes would be responsible for raising the funds necessary to purchase the land at market value, construct the infrastructure, and construct the facilities. This alternative provides no mechanism or financing commitments other than existing taxing authorities to ensure that desired community facilities would be provided. County zoning regulations would be the mechanism used to ensure that land is used according to the conditions of the Townsite Act.

The transit center would be developed on NFS land pursuant to the terms of a special use permit. Uses associated with the transit center would be subject to the monitoring and enforcement mechanisms incorporated in the joint, Forest Service/NPS special use permit and the renewal process for special use permits.

Commitments related to development of the federal housing complex would be assured through the terms and conditions of the Memorandum of Agreement between the USDA and USDI. Construction of NPS housing is contingent on NPS securing funds.

#### Cumulative Impacts

Commercial and residential development could potentially occur on several CFV-controlled private inholdings and on existing private land in Tusayan. Development on private land would continue to follow market forces, at the discretion of the landowner, subject to county zoning regulations. Local land use and development policies do not provide any assurances that housing and community services and facilities would be developed on private land in the Grand Canyon/Tusayan area.

### Alternative G

#### Direct and Indirect Impacts

Development agreements, county zoning, and a local governing body (the Kaibab Institute) would provide assurances that the commitments proposed by CFV

related to commercial development, housing, information and education facilities, transportation, conservation, open space, and design of the development would be carried out during the implementation and the life of the project. This alternative would embody these commitments in a development agreement with Coconino County, ensuring that the commitments are not subject to future reconsideration through the local zoning process. The alternative also proposes to base these commitments in future deed restrictions that bind all landowners and provide a supplement to local governmental enforcement of the commitments. The alternative also proposes the creation of a non-profit entity, the Kaibab Institute. As proposed, the Kaibab Institute would be the primary entity responsible for ensuring that commitments are adhered to by property owners and residents of CFV. The alternative also incorporates a permanent revenue source that would provide the funds necessary to ensure compliance with these commitments.

CFV has committed to providing improved land or building space for community facilities. With the exception of a community center and neighborhood parks which would be provided by CFV, there is no assurance that community facilities would be built because the funding source for construction of the facilities is undetermined. Like Alternative F, construction of NPS housing would be contingent on NPS securing funds.

#### Cumulative Impacts

Redevelopment of the existing private lands in Tusayan is likely, with the focus on construction of new commercial properties (lodging, retail, and food and beverage) and redesign of the highway frontage landscape. This redevelopment would result in an increased employment base that would in turn create demand for housing and additional community services and facilities. Requirements of the Tusayan Area Plan would assure that housing was provided for employees of new commercial properties.

### Alternative H

#### Direct and Indirect Impacts

Impacts regarding development plan assurances under Alternative H would be similar to those described under Alternative and G, except that a police/fire station would also be built, equipped, and donated by CFV.

#### Cumulative Impacts

Cumulative impacts to development plan assurances under Alternative H would be the same as described under Alternative G.

## Cultural Resources

> **Issue:** Development of private or NFS land near Tusayan could impact archaeological sites, traditional cultural properties of local and regional American Indian groups, and historic resources associated with railroad, logging, and livestock operations.

### Methods for Analysis

No new methods are proposed.

### Alternative F

#### Direct and Indirect Impacts

Under Alternative F, three of the four sites found on NFS land (masonry structures, a rock shelter, and a lithic scatter/rock shelter) would be outside the proposed development area. The fourth site, a lithic procurement area, would be within the proposed parking area at the transit center. Adverse effects to cultural resource sites within the development area eligible for listing on the National Register for Historic Places would be mitigated through implementing a data recovery plan to ensure that data and information contained in those sites are not lost. This procedure would be developed in consultation with the KNF, the SHPO, and the tribes.

#### Cumulative Impacts

Archaeological sites found on the private inholdings would remain in private ownership and vulnerable to private management actions, subject to state and federal laws pertaining to cultural resources on private land. Cultural resource regulations typically do not apply to private land unless other federal actions are involved or human remains are discovered on the private land. If the private inholdings are developed, it

is possible that some sites would be lost along with their associated information.

The three inholdings considered to have the greatest potential for development (Kotzin, TenX, and Lower Basin) contain a total of 20 cultural resource sites, including sherd and lithic scatters, rock alignments, sweat lodges, masonry structures, railroad grade, and homestead.

Any alternative whose implementation would result in a decrease in discharge at Havasu Springs should be considered as having an adverse cultural effect on the Havasupai Tribe. The quantity of the reduction in discharge should not be considered as a measure of the severity of the cultural impact. The Havasupai literally consider Havasu Springs and other canyon springs to be their cultural and spiritual life-blood. The redevelopment of Tusayan and potential development of the private inholdings would use groundwater as a source of water supply, and therefore, would affect discharges at Havasu Springs and other springs and seeps that discharge from the Redwall-Muav aquifer. Please refer to the discussion of impacts on Grand Canyon water resources for a more detailed discussion of those impacts. Similarly, the Hopi consider any decrease in discharge at Blue Springs as an adverse cultural impact as they attach important cultural significance to this locale. If Lower Basin were developed and on-site groundwater wells were drilled to the regional aquifer, the wells would intercept water that would have discharged at Blue Springs.

### Alternative G

#### Direct and Indirect Impacts

Under Alternative G, three of the four sites found on NFS land (masonry structures, a rock shelter, and a lithic scatter/rock shelter) would be within the proposed development area of INSIGHT. The fourth site, a lithic procurement area, would be within the transit center phase I parking lot. Adverse effects to cultural resource sites within the development area eligible for listing on the National Register of Historic Places would be mitigated by implementing a data recovery plan to ensure that data and information contained in those sites are not lost. This procedure would be developed in consultation with the KNF, the SHPO, and the tribes.

Through the land exchange, the Forest Service would acquire up to 102 cultural resource sites. These sites would be subject to federal cultural resource laws and afforded greater protection under federal ownership and management. Table 4.33 shows the breakdown of archaeological sites by private inholding.

**Table 4.33 Cultural Resource Sites Found on the 12 Private Inholdings Offered for Exchange to the Kaibab National Forest**

| Private Inholding | Number of Cultural Resource Sites |
|---|---|
| Lower Basin | 16 |
| Kotzin | 0 |
| TenX | 4 |
| Curley Wallace | 5 |
| Apex Siding | 5 |
| Trash Dam | 14 |
| Willows | 9 |
| Babbitt Tank | 10 |
| Anita | 12 |
| East Harbison | 19 |
| Young | 5 |
| Peterson | 3 |
| **Total** | **102** |

Under Alternative G, groundwater from the regional aquifer would serve as the primary source of water for the CFV development. This would result in a decrease in discharge at Havasu Springs and should be considered as having an adverse cultural effect on the Havasupai Tribe. The quantity of the reduction in discharge should not be considered as a measure of the severity of the cultural impact. The Havasupai Tribe literally consider Havasu Springs and other canyon springs to be their cultural and spiritual life-blood.

#### Cumulative Impacts

Development on other private land, state land, and tribal land in the Grand Canyon/Tusayan area could increase the likelihood of disturbance of cultural resource sites on those lands. Additional development in the Grand Canyon/Tusayan area would also result in additional groundwater withdrawals from the regional aquifer. The impact of this additional groundwater

withdrawal should be considered as having an adverse cultural effect on the Havasupai Tribe.

### Alternative H

#### Direct and Indirect Impacts

Impacts to cultural resources would be similar to those described under Alternative G, except that this alternative would only use groundwater during emergency situations. Because this alternative would not use groundwater as a primarily water source, it would not contribute to adverse cultural impacts to the Havasupai Tribe related to seeps and springs in Grand Canyon.

#### Cumulative Impacts

Cumulative impacts to cultural resources under Alternative H would be the same as described under Alternative G.

## Biological Resources

Impacts to biological resources have been divided into three categories: vegetation; wildlife; and threatened and endangered species.

## Vegetation

**Issue:** Development of private or NFS land near Tusayan could affect the types and acreage of vegetation available on the Forest. A portion of the NFS land is suitable for commercial timber production, and development may result in a decrease in the timber supply available from the Forest.

### Methods for Analysis

No new methods are proposed.

### Alternative F

#### Direct and Indirect Impacts

A total of 110 acres of ponderosa pine, pinyon-juniper woodlands, sagebrush flats, and grassland habitat would be removed to accommodate planned development, representing less than 0.04% of the total number of acres of these vegetation types on the Tusayan Ranger District. Although some native landscaping would likely be incorporated into the development, vegetation would be removed from most of this area.

#### Cumulative Impacts

If the Kotzin, TenX, and Lower Basin private inholdings are developed, up to an additional 674 acres of ponderosa pine forest, pinyon-juniper woodland, and sagebrush flats could be removed. Together, this would correspond to approximately 0.23% of the total acres of these vegetation types on the Tusayan Ranger District.

### Alternative G

#### Direct and Indirect Impacts

Alternative G would result in the disturbance of 237 acres of ponderosa pine, pinyon-juniper, and sagebrush vegetation to accommodate planned development. A total of 91 acres of the total development area (including the NFS land under special use permit) would remain as open space within the proposed development area. Vegetation removed under this alternative would represent about 0.1% of these vegetation types on the Tusayan Ranger District of the KNF. Native vegetation would also be used in this alternative to landscape and revegetate cleared areas following construction.

Up to 2,184 acres of ponderosa pine forest, pinyon-juniper woodland, sagebrush flats, and grassland habitat associated with the private inholdings would come under federal ownership and management, representing a 7% increase in these vegetation types on the Tusayan Ranger District.

#### Cumulative Impacts

Foreseeable future actions that would contribute to additional removal of vegetation in the Tusayan area include ongoing and planned development in Tusayan and planned expansion of Grand Canyon Airport. Development in these areas would not include clearing a substantial amount of native vegetation.

### Alternative H

#### Direct and Indirect Impacts

Impacts to vegetation under Alternative H would be similar to those described under Alternative G.

#### Cumulative Impacts
Cumulative impacts to vegetation under Alternative H would be the same as described under Alternative G.

## Wildlife

> **Issue:** Development of private or NFS land near Tusayan could affect known deer-fawning, elk-calving, and turkey-roosting habitat, as well as other game management areas in the vicinity of the NFS land. It could also affect nearby wildlife movement corridors and would likely increase human disturbance of these and other wildlife populations near the NFS land.

### Methods for Analysis
No new methods are proposed.

### Alternative F
#### Direct and Indirect Impacts
Under Alternative F, development of the NFS land would result in the disruption of 110 acres of wildlife habitat, with a potential to displace local wildlife populations and disturb wildlife in a zone of influence surrounding the development. This impact would be somewhat reduced because the land proposed for development is already within an area of human disturbance.

#### Cumulative Impacts
Potential development of the Kotzin, TenX, and Lower Basin private inholdings could result in disruption of habitat on up to 674 acres of wildlife habitat, creating habitat fragmentation and collectively a greater zone of influence from human activities. A total of six ephemeral stock tanks on the TenX and Lower Basin private inholdings, representing approximately 4% of the total number of stock tanks on the Tusayan Ranger District could be eliminated from wildlife use if these inholdings were developed.

### Alternative G
#### Direct and Indirect Impacts
Development of the NFS land under Alternative G would result in the disruption of 328 acres of wildlife habitat, with a potential to displace local wildlife populations and disturb wildlife in a zone of influence surrounding the development. This impact would be somewhat reduced because the land proposed for development is already within an area of human influence.

Up to 2,184 acres of wildlife habitat would come under federal ownership and management from acquisition of the private inholdings. The KNF would acquire private land composed primarily of bottom lands with generally high forage production and containing a total of 17 ephemeral stock tanks representing approximately 12% of the stock tanks on the Tusayan Ranger District. These stock tanks provide water for wildlife on a seasonal basis.

#### Cumulative Impacts
Existing and planned development in the Tusayan area would contribute to wildlife displacement and disturbance effects around the NFS land. Effects on wildlife would be concentrated in the Tusayan area, with zones of influence extending outward from Tusayan, Grand Canyon Airport, and the CFV development on former NFS land.

### Alternative H
#### Direct and Indirect Impacts
Impacts to wildlife under Alternative H would be the same as those described under Alternative G.

#### Cumulative Impacts
Cumulative impacts to wildlife under Alternative H would be the same as described under Alternative G.

## Threatened, Endangered, and Sensitive Species

> **Issue:** Development of private or NFS lands near Tusayan could affect populations of TES plants and/or animals. Additional TES species habitat may be gained by Federal acquisition of the private inholdings.

### Methods for Analysis
No new methods are proposed.

### Alternative F
#### Direct and Indirect Impacts
No known federally listed plant or animal species would be affected on the NFS land under Alternative F.

Under Alternative F, no known populations of Tusayan flameflower, a Forest Service sensitive plant species, would be affected by development of the NFS land. About 110 acres of possible habitat for the northern goshawk and the flammulated owl would be impacted. A larger zone of influence would extend around the community development and transit center, but this would not be expected to affect population viability of these species.

### Cumulative Impacts

Potential cumulative effects of Alternative F on special interest species or habitat would include potential development of the Kotzin, TenX, and Lower Basin private inholdings which could affect the Arizona leatherflower (a Federal Candidate species), Tusayan flameflower, northern goshawk, flammulated owl, Navajo Mountain Mexican vole, and occult little brown bat (Forest Service Sensitive species). Two small populations of Arizona leatherflower, totaling about 40 plants, are known to occur on the TenX private inholding. If TenX is developed, up to 13% of the known number of Arizona leatherflower plants on the Tusayan Ranger District could be impacted or destroyed. Three populations of Tusayan flameflower, totaling about 100 individuals, are known to occur on the TenX inholding, and 10 populations, totaling at least 370 individuals, are known to occur on the Kotzin inholding. These populations account for about 3% of the known number of Tusayan flameflower plants on the Tusayan Ranger District.

Possible habitat for the flammulated owl, northern goshawk, and Navajo Mountain Mexican vole occurs on the Kotzin and TenX inholdings and possible habitat for the occult little brown bat occurs on TenX. It is unlikely that the population viability of these species would be affected by the development of these inholdings.

Known and possible habitat for Forest Service sensitive species on the other nine private inholdings would remain in private ownership. Because of the lower likelihood of their development, these lands would likely remain in their undeveloped state. Known habitat for disturbed rabbitbrush on the Curley Wallace inholding and possible habitat for the Navajo Mountain Mexican vole on the other private inholdings would remain in private ownership.

As visitors and residents seek additional recreational opportunities outside GCNP, visitation to NFS land surrounding Tusayan and the private inholdings may increase. Such visitation may affect special interest species or their habitat. The Tusayan flameflower, the northern goshawk, and the flammulated owl would be the species most likely to be impacted. Populations of the Tusayan flameflower were recorded by KNF in 1994 to the south and east of Grand Canyon Airport, and a northern goshawk has been sighted south of the airport. Possible habitat for the flammulated owl occurs throughout the Tusayan Ranger District in ponderosa pine forest habitats.

## Alternative G

### Direct and Indirect Impacts

No known federally listed plant or animal species would be affected on the NFS land under Alternative G.

Under Alternative G, development of the NFS land could affect seven populations of Tusayan flameflower, totaling about 135 plants and representing less than 1% of the known number of individuals on the Tusayan Ranger District. Concentrations of the Tusayan flameflower on the NFS land would be fenced and avoided during construction to the extent possible. Development activities not expected to impact population viability of this species. About 270 acres of possible habitat for the northern goshawk and flammulated owl would be directly affected by development activities. A larger zone of influence would extend around the development, but development activities would not be expected to affect population viability.

Federal acquisition of private inholdings would place known habitat of the Arizona leatherflower, Tusayan flameflower, disturbed rabbitbrush, and possible habitat for the northern goshawk, flammulated owl, occult little brown bat, and Navajo Mountain Mexican vole under federal ownership and management.

### Cumulative Impacts
Redevelopment of the existing private land in Tusayan would not impact TES species or their habitat.

### Alternative H
#### Direct and Indirect Impacts
Impacts to threatened, endangered, and sensitive species under Alternative H would be the same as those described under Alternative G.

#### Cumulative Impacts
Cumulative impacts to threatened, endangered, and sensitive species under Alternative H would be the same as described under Alternative G.

## Forest Service Management
Impacts to Forest Service management have been divided into three categories: Forest Service management objectives, public recreational opportunities, and fire management programs. Forest Service management objectives have been further divided into livestock grazing, soil and water, special land uses, and property boundary management.

### Forest Service Management Objectives

**Issue:** Using NFS land for development of visitor facilities and community services could affect the KNF's ability to effectively manage these resources in the areas adjacent to development.

### Methods for Analysis
No new methods are proposed.

### Alternative F
#### Direct and Indirect Impacts
**Livestock Grazing**
Under Alternative F, a total of 110 acres of NFS land would be eliminated from the Rain Tank Allotment. No change in the permitted number of livestock would occur as a result of this alternative.

**Soil and Water**
Development and the associated creation of impervious surfaces would occur on approximately 88 acres. No appreciable changes in peak flow or runoff volume could occur under existing federal law. No existing surface water would be eliminated.

**Special Land Uses**
Under Alternative F, existing special use permit boundaries in the Tusayan area would not be affected, including those for Moqui Lodge and Apache Stables. Implementation of this alternative would not preclude redevelopment of Moqui Lodge in its present location or potential relocation of Moqui Lodge to another site. Economic impacts to Moqui Lodge are discussed under socioeconomic impacts to the Grand Canyon/Tusayan area. Additional special use permits and easements for utility corridors and access roads are likely for the development of community services and facilities on the Townsite Act land. The transit center would require the issuance of a special use permit through the competitive bidding process.

**Property Boundary Management**
This alternative would result an increase of about 1 mile of new boundary and about 3 property corners on the Tusayan Ranger District.

#### Cumulative Impacts
**Livestock Grazing**
Seventeen stock tanks associated with the private inholdings would remain in private ownership. No change in the respective grazing allotment sizes would occur from development of the private inholdings. Potential development of the Kotzin, Lower Basin, and TenX private inholdings could result in the modification of some rangeland and potential loss of access to six stocks tanks used by livestock. The other private inholdings would likely remain in an undeveloped state and would continue to be used for livestock grazing.

**Soil and Water**
Soil and vegetation resources on the private inholdings would remain in private ownership.

**Special Land Uses**
Development of the private inholdings would result in more encumbrances on the Tusayan Ranger District, and additional requests for special use permits for

utilities, services, and facilities on NFS land surrounding the private inholdings.

**Property Boundary Management**
KNF would continue current boundary management practices and procedures. The exchange of 12 private inholdings would not occur, leaving them in private ownership. The value of the private inholdings may increase over time and an opportunity to acquire them may be lost because of increased value or possible development.

### Alternative G

#### Direct and Indirect Impacts

**Livestock Grazing**
A total of 328 acres would be eliminated from the Rain Tank Allotment under Alternative G. No change in the number of permitted livestock. Up to 2,184 acres of rangeland on the private inholdings would be acquired and come under management by KNF. The private inholdings include some productive bottom lands and a total of 17 stock tanks.

**Soil and Water**
Development and the associated creation of impervious surfaces would occur on a total of approximately 237 acres. No existing surface water would be eliminated. No increase in peak flow or runoff volume could occur under existing federal law. KNF management of vegetation and soil on the private inholdings would facilitate improvement of watershed conditions on the Tusayan Ranger District through active management.

**Special Land Uses**
Existing special use permit boundaries in the Tusayan area would not be affected, including those for Moqui Lodge and Apache Stables. Implementation of this alternative would not preclude redevelopment of Moqui Lodge in its present location or potential relocation of Moqui Lodge to another site. Economic impacts to Moqui Lodge are discussed under socioeconomic impacts to the Grand Canyon/Tusayan area. Development adjacent to Moqui Lodge would create opportunities for shared infrastructure, particularly wastewater treatment facilities. The existing wastewater treatment system at Moqui Lodge is operating at capacity and would have to be upgraded as part of any expansion of Moqui Lodge.

Development of the NFS land in this alternative would likely result in additional special uses on the Tusayan Ranger District for utility corridors. As with Alternative F, the transit center would require the issuance of a special use permit through the competitive bidding process.

**Property Boundary Management**
Conveyance of NFS land under Alternative G would result in about 2.5 miles of new boundary and 8 new corners. Acquisition of the private inholdings would result in a decrease of about 35 miles of boundary and 123 property corners.

#### Cumulative Impacts

Additional requests for special land uses for NFS land adjacent to Tusayan are likely from the redevelopment of the commercial properties in Tusayan.

### Alternative H

#### Direct and Indirect Impacts

Impacts to Forest Service management objectives under Alternative H would be the same as those described under Alternative G.

#### Cumulative Impacts

Cumulative impacts to Forest Service management objectives under Alternative H would be the same as described under Alternative G.

## Public Recreation Opportunities

> **Issue:** Development of private or NFS lands near Tusayan may affect recreational opportunities in the area. Development of the NFS land may affect the proposed expansion of TenX Campground.

### Methods for Analysis

No new methods are proposed.

### Alternative F

#### Direct and Indirect Impacts

Recreational opportunities for dispersed camping, hiking, and horseback riding would be eliminated on 110 acres of NFS land proposed for development under Alternative F. NFS land in this alternative is classified as a Roaded Natural Area on the Recreational

Opportunity Spectrum (ROS). This ROS classification currently makes up approximately 66% of the land area on the Tusayan Ranger District.

### Cumulative Impacts

With proposed redevelopment of Tusayan, the Camper Village Campground/RV park would be developed into mixed-use commercial services. Expansion of the TenX Campground by an additional 150 camp sites could occur as proposed by the KNF. The proposed expansion of TenX would help to absorb the demand created by the closure of Camper Village Campground, but may not entirely satisfy total demand for camping in the Grand Canyon/Tusayan area.

Dispersed recreational uses on the private inholdings would likely continue, but future restrictions could be imposed by the private landowners. Dispersed recreational use of the Kotzin, TenX, and Lower Basin parcels could be eliminated by private development of these inholdings.

Redevelopment of Tusayan and potential development of private inholdings could result in the development of two education/interpretive centers: Destination Cinema and INSIGHT. These facilities would provide additional recreational and education opportunities for visitors to GCNP.

## Alternative G

### Direct and Indirect Impacts

Opportunities for dispersed camping, hiking, and horseback riding would be eliminated on 328 acres of NFS land proposed for development under Alternative G. Dispersed recreational uses occurring on the private inholdings would be allowed to continue with federal acquisition and management of the private inholdings

No campground/RV park would be constructed in the CFV development under this alternative.

INSIGHT would be developed on the NFS land acquired through exchange. INSIGHT would provide additional recreational and educational opportunities for visitors to GCNP.

The Willows private inholding is in an area classified as Semi-Primitive Motorized. The acquisition of the Willows inholding would result in an increase of 160 acres of Semi-Primitive Motorized land on the Tusayan Ranger District. This ROS classification comprises approximately 20% of the land area on the Tusayan Ranger District. There would also be a net increase of up to 1,622 acres of Roaded Natural Area on the Tusayan Ranger District through the acquisition of the other private inholdings.

### Cumulative Impacts

Expansion of the TenX Campground by an additional 150 camp sites could occur as proposed by the KNF. The proposed expansion of TenX would help to absorb the demand created by the closure of Camper Village Campground, but may not entirely satisfy total demand for camping in the Grand Canyon/Tusayan area. With redevelopment of Tusayan, Destination Cinema in conjunction with the National Geographic Society, may pursue building an education/interpretation center in conjunction with the redesign of IMAX. This would provide additional recreational and education opportunities for visitors to GCNP.

## Alternative H

### Direct and Indirect Impacts

Direct and indirect impacts to public recreation opportunities under Alternative H would be the same as described under Alternative G.

### Cumulative Impacts

Cumulative impacts to public recreation opportunities under Alternative H would be the same as described under Alternative G.

# Fire Management Programs

**Issue:** Development of private or NFS lands near Tusayan may affect the amount of wildland/urban interface and increase fire risk, affecting fire suppression efficiency.

## Methods for Analysis

No new methods are proposed.

## Alternative F

### Direct and Indirect Impacts

Fire risk would increase from urban development of 110 acres of NFS land. The NFS land proposed for

development is adjacent to Tusayan and State Highway 64, allowing for prompt wildland fire response by KNF, GCNP, and potentially, the Tusayan Fire District.

#### Cumulative Impacts

Potential development of the private inholdings would result in a greater area of wildland/urban interface and increased fire risk from new populations in areas previously undeveloped. If developed, the remote nature of the private inholdings could affect fire response time and emergency services, particularly if fire protection services are not provided on the developed private inholdings.

### Alternative G

#### Direct and Indirect Impacts

Fire risk would increase from the urban development of 328 acres of NFS land. The NFS land proposed for development is adjacent to Tusayan and State Highway 64, allowing for prompt wildland fire response by KNF, GCNP, and potentially, the Tusayan Fire District.

#### Cumulative Impacts

Federal acquisition of the private inholdings would preclude them from being developed and would reduce the potential for a greater area of wildland/urban interface in the Tusayan Ranger District.

### Alternative H

#### Direct and Indirect Impacts

Direct and indirect impacts to wildland fire management programs under Alternative H would be the same as described under Alternative G.

#### Cumulative Impacts

Cumulative impacts to wildland fire management programs under Alternative H would be the same as described under Alternative G.

## Environmental Consequences or Factors Not Identified as Major Issues or Concerns

### Effects on Consumers, Civil Rights Legislation, Minority Groups, and Women

Various civil rights, affirmative action, and equal employment opportunity acts and regulations require that any federal action must carry out hiring, supervisory, and contracting practices that meet established regional and national goals for civil rights. If an action alternative is selected, the proponent or permittee and the contractors would be required to maintain these practices.

An analysis of impacts with regard to disproportionately adverse impacts on minority and/or low-income groups, including American Indians, was undertaken. A review of chapter 4, including the analysis of socioeconomic resources, employment opportunities, surface water and groundwater quality, air quality, hazardous materials, and other elements of the human environment, indicates that American Indians and other minority and/or low-income groups are not disproportionately affected by the alternatives.

### Effects on Prime Farmland and Range Land

There are no prime farm, range, or forest lands, or roadless, wilderness, natural, or study areas on the federal lands proposed for exchange or acquisition under the Townsite Act. Range land is present on the private inholdings, and the federal acquisition of the private inholdings would provide a net increase of range land for the Forest Service.

### Effects on Wetlands and Flood Plains

The NFS land and private inholdings involved in this analysis were surveyed for floodplains and wetlands. No jurisdictional wetlands were found on either the NFS or private land. Floodplains of less than 30 feet were found on the Young, Curley Wallace, Apex Siding, and East Harbison inholdings, totaling less than one acre; five acres of floodplains were found on the Kotzin inholding; and approximately 35 acres of floodplains were found on the NFS land (within Long Jim Canyon). Any drainages or water catchments such

as stock tanks that were found during surveys lacked the vegetative components required to qualify as jurisdictional wetlands. Soil and underlying bedrock are too permeable to allow the prolonged surface saturation required for the development of hydric soil characteristics and the growth of hydrophytic (water-loving) vegetation. None of the alternatives conflict with Executive Order 11988 regarding floodplain management or Executive Order 11990 regarding wetland management.

## Effects on Minerals, Geothermal Resources, Oil, and Gas

A Mineral Report, assessing the mineral potential of NFS and private inholdings, was prepared. The BLM has concurred that there is low potential for locatable minerals on most of the private inholdings and the NFS land involved in this analysis. There is moderate potential for locatable minerals on the Babbitt private inholding. There is low to moderate potential for mineral materials and low potential for leasable minerals on the private inholdings and NFS land involved in this analysis.

Within the private and NFS land involved in this analysis, there is no potential for coal, oil, gas, or solid minerals. There is low to moderate potential for common-variety minerals. Copper and uranium have historically been mined in the area, although no evidence of prospecting or mining for these minerals was found. There are no active mining claims on or within the immediate vicinity of the NFS land. There are no Forest Service or BLM mineral leases or permits on or within the proximity of the NFS land. Borrow pits for rock and dirt were identified. These materials are abundant in the area.

The Babbitt private inholding has moderate potential for locatable minerals from its proximity to a mineralized, collapsed breccia pipe on an adjacent 40-acre tract of private land that is excluded from the proposed exchange.

## Effects on Hazardous Materials

A field review and records check of both the private and NFS land for the presence of hazardous substances was completed as required by 40 CFR 273.3(a). The land involved in this analysis has been examined in accordance with Section 120(h) of the Comprehensive Environmental Response, Compensation and Liability Act (26 U.S.C. 4611-4682, and as amended by 42 U.S.C. 9601-9657). Western Technologies, Inc., prepared the Phase I Environmental Site Assessment for GCIA on roughly 96 acres of NFS land directly north of Tusayan. Geotechnical and Environmental Consultants, Inc., prepared the Transaction Screens for CFV on the 12 private inholdings and 672 acres of NFS land.

Western Technologies reported, "No evidence exists to suggest the presence of environmental concerns from facilities identified during our database research." They concluded that this assessment revealed no evidence of recognized environmental conditions in connection with the NFS land and recommended no further assessment.

Geotechnical and Environmental Consultants prepared preliminary data to aid in evaluating the 12 private inholdings and 672 acres of NFS land proposed for exchange for the presence of significant quantities of disposed hazardous and petroleum substances resulting from past or present uses. Several sites require additional studies to provide a more detailed evaluation: TenX, Lower Basin, Babbitt Tank, Kotzin, Anita Station, East Harbison, and Apex Siding.

Based on this information, a Phase I/Phase II Environmental Site Assessment is recommended for the NFS land and the TenX, Lower Basin, Kotzin, Willows, Babbitt Tank, Anita Station, East Harbison, and Apex Siding inholdings. No further work is recommended for the Curley Wallace, Trash Dam, or Peterson inholdings.

## Effects on Cave Resources

The Cave Resources Protection Act of 1988 (Public Law 100-691 [16 U.S.C. 4301 et seq.;102 Stat. 4546]) establishes requirements for the management and protection of caves and their resources on federal land. One cave was found on the NFS land involved in this analysis, approximately midway between the Kotzin inholding and State Highway 64. SWCA, Inc., evaluated the cave found in Section 13, Township 30 North, Range 2 East on the USGS 7.5 minute topographic map for Tusayan West, Arizona. The cave

is an outcrop of Kaibab limestone in a wooded area. Two entrances lead to a roughly oval area approximately measuring 289 feet by 66 feet, with a dome 12 feet in height. Six specific criteria are used to evaluate caves and determine their significance. These criteria and the findings are listed in Table 4.34.

**Table 4.34 NFS Criteria for Evaluation of Caves and Findings for the Cave Found on NFS Land Proposed for Exchange under Alternatives B, C, G, and H**

| NFS Criteria | Findings |
|---|---|
| Biota | No evidence was found of flora or fauna native to caves or restricted to caves, or of any species that are on sensitive, threatened, or endangered species lists. |
| Cultural | Due to recent human presence, it is unlikely that any historic or archeological resources are intact and in situ in this cave. It is likely that the cave was used in prehistory, as artifacts have been found in the immediate vicinity. The Forest Service has no record of excavation. |
| Geologic/Mineralogical/Paleontologic | The cave is in Kaibab limestone with patches of calcite with no highly-developed crystalline structures. No bones were visible. |
| Hydrologic | The cave contains no permanent water but appears to receive some drainage and/or runoff from the surface and may be flooded on an irregular seasonal basis. The cave is on a ridge above a wash (Long Jim Canyon) that is below the lowest depth of the cave. Therefore, the cave is probably not a direct aquifer recharge feature. |
| Recreational | The cave shows evidence of recent use for non-organized recreational activity. |
| Educational or Scientific | As the cave shows evidence of contemporary human disturbance and is not in a pristine state, it offers very limited opportunities for educational or scientific use. |

Because of the natural characteristics of the cave and recent human disturbance, the resources offered by this cave are limited. None of the alternatives involved in this EIS conflict with the Cave Resources Protection Act.

## Irreversible and Irretrievable Commitments of Resources

Irreversible commitment of resources refers to nonrenewable resources, such as cultural resources, or to those factors that are renewable only over long periods of time, such as soil productivity. Irretrievable commitment applies to losses of production, harvest or use of renewable natural resources. For example, timber production and grazing capabilities are irretrievably lost while the area is used for visitor and community services and facilities. The production lost is irretrievable, but the action is not irreversible.

Development of the NFS land represents an essentially permanent commitment of the area. This development is not a completely irreversible or irretrievable commitment of resources, but from a practical standpoint, it can be considered as such. Should the time come that development is no longer desired, the various facilities could be dismantled and removed and the area revegetated or allowed to return to a natural state.

Examples of irreversible commitments include construction of new roads and parking areas, because of the earthwork required. Other aspects of development, including utility easements and landscaping could be reversed and natural resources restored over time. Vegetation removed for development is an irretrievable impact for at least the life of the project. Some loss of wildlife habitat is also irretrievable for the life of the project. Increased human disturbance may cause some species to permanently avoid the area, thus indirectly impacting the carrying capacity of their habitat in the vicinity.

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## Distribution List

The following list includes the agencies, congressional delegation, city councilman, tribal representatives, organizations, and individuals who are on the mailing list for distribution of information about this project, including the environmental impact statement.

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Bureau of Land Management - State Director, Phoenix
Bureau of Reclamation - Flagstaff
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Grand Canyon National Park - Superintendent, I-Team Manager
House Committee on Government Operations - Subcommittee on Environment, Energy, and Natural Resources
Soil Conservation Service
U.S. Army Corps of Engineers - Phoenix
U.S. Army Corps of Engineers - Los Angeles
U.S. Attorney's Office - Phoenix
U.S. Environmental Protection Agency - San Francisco
U.S. Fish and Wildlife Service - Phoenix
U.S. Forest Service - Southwestern Region
U.S. Forest Service - Arizona Zone Office
U.S. Forest Service - Environmental Coordinator, Washington DC
U.S. Forest Service - Land Management Planning Staff, Washington DC
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Senator John Raidt (Leg. Assistant)
State Representative - Jack Jackson

**State Agencies**
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ADEQ - Director
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ADEQ - Non-point Source Unit
ADEQ - Solid Waste
ADEQ - Water Quality
Arizona Department of Transportation (ADOT)-Chairman, Phoenix
ADOT - Environmental Planning, Phoenix
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ADOT - Traffic Engineer, Prescott
ADOT - Grand Canyon Airport Manager
Arizona Department of Water Resources - Director
Arizona Game and Fish Department- Mesa
Arizona Game and Fish Department- Flagstaff
Arizona Game and Fish Department- Phoenix
Arizona Office of Tourism
Arizona State Land Department - Commissioner
Arizona State Land Department - Deputy Commissioner

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Coconino County Board of Supervisors - Tom Chabin
Coconino County Board of Supervisors - Paul Babbitt
Coconino County Sheriff's Department - Tusayan

Coconino County Sheriff's Department - Flagstaff
Coconino County Library Board - Chairman
Yavapai County Board of Supervisors

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City of Flagstaff - Councilmen Norm Wallen
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City of Holbrook - Mayor
City of Holbrook - Chamber of Commerce
City of Page - Mayor
City of Sedona - Mayor and City Council
City of Seligman - Chamber of Commerce
City of Show Low - Mayor
City of Williams - Mayor
City of Wiliams (and Grand Canyon) - Chamber of Commerce
City of Williams - Unified School District #2
City of Winslow - Mayor
Grand Canyon - Chamber of Commerce
Grand Canyon - School District #4
Grand Canyon - South Grand Canyon Sanitary District
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Town of Fredonia - Mayor
Town of Jerome - Vice Mayor
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Hopi Tribe
Hualapai Tribe
Kaiabab Piute Tribe
Navajo Nation - Cameron Chapter
Navajo Nation - Tuba City Chapter
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San Juan Southern Paiute Tribe
Yavapai Apache Tribal Council
Zuni Tribe

**Organizations**
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American Legion - Flagstaff
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Applied Ecosystems Management
Arizona Daily Sun
Arizona Education Association
Arizona Engineering Company
Arizona KOA Owners
Arizona Mining Association
Arizona Mountain Inn
Arizona Prospectors and Small Mine Operators
Arizona Public Service (APS)
Arizona Republic
Arizona Wilderness Coalition
Arizona Wildlife Federation
Ask Fork Development Association
Babbitt Brothers Trading Company
Bank One
Bar U Bar Ranch Inc.
Beck Industries
Bedrock Development Inc.
Best Western Grand Canyon Squire Inn
Bikeway Committee
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Boy Scouts of America - Roosevelt Council
Briar Patch Inn
Budget Rent-a-Car
Buffalo Park Coalition
Butler Motel
Camper Village
Center for Environmental Studies
Center for Urban Affairs and Policy Regulation
Cheers
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Citizens Utilities
Coconino Estates Pool Association
Coconino Park Association

Coconino Sportsmen
Cocopai RC&D
Coldwell Bankers
Colorado River Inn
Communication Station
COPEC Alliance
Cosmic Cycles
GCNP Lodges - Director of Transportation
Dallas Real Estate
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Dollar Rent-a-Car
Elks Lodge BPOE No. 499
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Forest Guardians
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Glen Canyon Environmental Studies
Grand Canyon Air Tourism Association
Grand Canyon Airlines
Grand Canyon Association
Grand Canyon Food Mart
Grand Canyon IMAX Theater
Grand Canyon Management
GCNP Science Center
Grand Canyon - McDonald's
Grand Canyon News
Grand Canyon Railway
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Northern Arizona Loggers Association
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Teamsters Local Union No. 104 - Flagstaff
The Awareness Journal
The Brook Group
The Business Journal
The Guide
The Inn at 410
The Journal
Thorp Associates
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